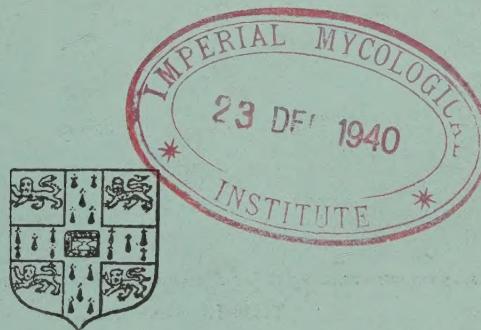


University of Cambridge
School of Agriculture Memoirs

Memoir Nos. 11-12

A brief summary of the papers published by
the Staffs of the School of Agriculture and
its Associated Research Institutes during
the period Oct. 1st, 1938—Sept. 30th, 1940.



CAMBRIDGE
1940

FOREWORD.

This Memoir, which is published under the general editorship of the Librarian of the School, represents an attempt to present as succinctly as possible the contributions made by members of the Staffs of the School of Agriculture and its Associated Institutes to the development and progress of Agricultural Science, to indicate to research workers interested the Journals in which the full papers are presented and to act as a complete record of papers published. Each summary is compiled by the author of the paper and is presented, so far as the subject matter will allow, in a non-technical form in order to be of value to the general body of farmers interested in the more recent developments of agricultural scientific research in general and of the activities of this Department in particular.

Requests for further information or criticism arising out of the summaries should be referred to the individual author concerned, criticisms and suggestions for the improvement of the Memoir itself should be addressed to the Librarian of the School.

The Librarian takes this opportunity of thanking all Institutions etc. who have kindly sent literature during the past year.

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ENGLAND.

CONTENTS

	PAGE
STAFF	2
INTRODUCTION	5
SUMMARIES	6
Agriculture	6
Agricultural Economics	9
Agricultural Engineering	11
Agricultural Zoology (including Entomology)	11
Animal Breeding and Genetics	14
Animal Nutrition	18
Animal Physiology	24
Animal Production	27
Forestry	30
Plant Breeding and Genetics	30
Plant Nutrition	33
Plant Pathology	34
Plant Physiology	37
Soils and Manures	38
Statistics	39
Miscellaneous	40
Author Index	41

Members of Staffs, summaries of whose papers are included in these Memoirs.

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University of Cambridge School of Agriculture Memoirs

THE SCHOOL OF AGRICULTURE INCLUDING ESTATE
MANAGEMENT, THE ADVISORY SERVICES
AND ASSOCIATED RESEARCH
INSTITUTES

Agricultural Education in Cambridge dates from 1892 when the Cambridge and Counties Agricultural Education Committee, an informal body consisting of University Professors and County Council representatives, first organized an Agricultural Course. In 1899 the University created a Department of Agriculture to take over the work of this Committee. The School of Agriculture was built by public subscription in 1909 and expanded by a grant from the Development Commission in 1912. The rapid expansion of the Animal Nutrition Institute and the Plant Breeding Institute under the direction of Professor T. B. Wood and Professor R. H. Biffen led to increased demands on accommodation, and an extension to the building was made in 1925–26 by the aid of a further grant from the Development Commission. The Estate Management Branch has been added since the war for the purpose of providing technical and professional assistance in the management of University and College property and with a view to affording opportunities for practical demonstrations in connection with the teaching of Estate Management subjects.

The Rockefeller Benefaction, made to the University in 1929, provided money for additional accommodation for the Department of Agriculture and for an expansion of its activities, and a new building was completed and occupied in March, 1933.

The Department of Agriculture is a teaching department of the University and offers courses of instruction leading to a degree or a post-graduate diploma. Research in the problems of agriculture and cognate sciences is carried out by members of the teaching staff and by members of the staffs of the Research Institutes attached to the Department. There are also a number of advisory officers who are available to offer assistance and advice to farmers on their problems. Additional facilities for both teaching and research are provided by the University Farm which occupies an area of some 700 acres within reasonable distance of the scientific laboratories.

* Reprints available for free distribution. Please quote marginal number instead of full title. Enquiries for papers not starred should be sent to the author.

AGRICULTURE.

GARNER, F. H.

Advanced Training in Animal Husbandry at the School of Agriculture, Cambridge.

C. R. Congr. Int. Zootech. Zürich, 1939. 331.

Advanced training in animal husbandry is provided at the School of Agriculture, Cambridge for a Diploma. Special provision is made to enable the graduate in pure science to transfer to agriculture. The course consists of some original experimental work and the preparation of a thesis, special attention being paid to statistical method. A discussion class is an important feature of the course. Some of the difficulties of animal experiments are discussed.

576* GARNER, F. H. & SANDERS, H. G.

Experiments on the Spacing of Sugar-beet. I. Results Based on Plot Yields.

J. Agric. Sci. 1939, 29, 48-57.

Although the yields of roots and sugar increase as the row distance decreases, there is little indication that rows narrower than 18 in. are economically worth while, as further narrowing gave only slight increase in yield. Weight of tops increases as row distance decreases.

Spacings in the row from 6 to 12 in. produce no difference in yield of roots or sugar, and consequently the convenience of working with 12 in. makes this spacing distance the most desirable in practice.

These experiments throw no light on the question as to whether optimum spacing is related to the level of fertility of the field ; this very important practical consideration is being investigated.

577* GARNER, F. H. & SANDERS, H. G.

Experiments on the Spacing of Sugar-beet. II. Results Based on Weights of Individual Plants.

J. Agric. Sci. 1939, 29, 58-68.

Yields of plots estimated from the known weights of "perfect" beet, i.e. plants with no gaps in the ring immediately surrounding them, showed 18 × 9 in. to be the optimum spacing.

Sugar analyses performed on individual "perfect" beet showed that very diminutive roots were low in sugar, but that in general sugar percentage decreased with increasing weight of root ; the decrease was, however, slight and only amounted to unity for an increase of 1000 g. in weight of root.

In a dry year the roots immediately surrounding a gap compensated to the extent of 80-89 per cent for the missing plant : the allocation to the individual neighbours was approximately inversely proportional to the square of their distance from the site of the gap. In a wet year compensation was less complete, amounting to from 41 to 84 per cent under various spacing treatments. In both years compensation was less complete in the case of tops than in the case of roots.

Within classes of beet similar in regard to spacing treatment and gappiness there still remained considerable variation due to soil and to genetic heterogeneity.

The genetic variability of commercial seed appears to be large, so that in sugar beet experiments it is very desirable that each plot should carry a considerable number of plants : in these experiments, assuming that all variations within ultimate classes were of genetic origin, 400 plants would have been necessary to reduce the plot error due to genetic variability to 2 per cent of the mean.

579* GARNER F. H. & SANDERS, H. G.

Four-year Leys : the Inclusion of Red Clover : First Year Management.

J. Agric. Sci. 1939, 29, 164-173.

Two experiments have been carried out on the Cambridge University Farm to test the desirability of including late-flowering red clover in the seeds mixture in the case of a 4-year ley, and to compare grazing with cutting for hay in the first harvest year.

The majority of the red clover survived for the first 2 years, during which it increased the yield of dry matter very markedly ; it did not lead to any reduction of yield in the last 2 years. By producing an early cover of the ground red clover checked the encroachment of weeds ; although it reduced the proportion of wild white clover in the herbage in the later years, the reduction was not serious.

Where the young plants were well established at the time, and normal weather conditions were experienced, grazing was definitely preferable to cutting for hay during the first harvest year. Where the plants were slow in establishing themselves, and in a superlatively dry spring and summer, grazing checked the development of the sward too much, and cutting for hay gave much better results.

648* GARNER, F. H. & SANDERS, H. G.

Studies with Lucerne (*Medicago sativa*)—Row Distances and “Smother” Crops.

J. Agric. Sci. 1940, **30**, 182–188.

Lucerne drilled at a constant seed rate per acre, in narrow rows (3½ and 7 in.), gave a greater yield per acre than when drilled in rows 10½ and 14 in. in width. Over a four-year period the yield of dry matter per acre from narrow rows was half a ton more than from wide rows. No evidence was obtained that weed infestation is reduced by narrow drilling.

The broadcasting of 5 lb. of trefoil per acre at the time the lucerne was drilled had no effect on the total yield or on weed infestation.

Wild white clover broadcast at the rate of 2 lb. per acre at the time of drilling the lucerne slightly reduced the yield of lucerne in the first harvest year, but subsequently it served to secure some control of weeds, and thereby favoured the persistence of the lucerne. Differences in yield associated with sowing wild white clover were, however, slight.

Commercial cocksfoot broadcast at the rate of 10 lb. per acre at the time of drilling the lucerne led to very considerable increases in total yield (nearly 3 tons per acre of dry matter over a four-year period). The increments were obtained principally during the spring growth, and some loss of lucerne plants was suffered, so that in a very dry summer the total aftermath yield was slightly reduced. Since cocksfoot almost completely controlled weeds and its mixture with lucerne was very suitable for hay or for silage, it is regarded as a plant that may be included in a lucerne ley with advantage.

578* HEY, G. B. & KEMSLEY, W. F. F.

Experiments on the Spacing of Sugar Beet. III. Further Statistical Considerations.

J. Agric. Sci. 1939, **29**, 69–75.

The distribution of the total weight of beet in small areas (2 yards by 1 yard) was examined, and estimates made of the effects of missing beet on the final yield, and of the yield to be obtained with various percentage plants.

The distribution of gaps over the field is found to be non-random. The percentage of gaps varies from block to block, but does not differ greatly between the spacings. Three methods were employed and gave consistent results.

SANDERS, H. G.

An Outline of British Crop Husbandry.

Pp. viii + 348. Camb. Univ. Press, 1939. Price 15s.

A book for farmers as well as for agricultural students, describing the general principles that underlie the varying practice (according to locality) of the main farming operations—rotations, manuring, cleaning, tillage, preparation of the seed bed, sowing, cultivation, and the harvesting of corn and roots. The author gives careful attention to methods based upon tradition and the underlying reasons for them.

OTHER PAPERS.

BIFFEN, R. H.

Annual Report for 1938 and 1939 of the Botanist.

J. R. Agric. Soc. 1938, **99**, 536–541 : 1940, **100** (3), 136–138.

CULPIN, C.

Now is the Time to Prepare for 1941.

Worcs C. C. Quart. Chron. 1940, **8**, 153–156.

568* EDE, R.

In the Beginning. 6. The School of Agriculture, University of Cambridge.

Agric. Progr. 1938, **15**, 137–142.

640* GARNER, F. H.

Grass Silage.

Dairy Fmr. 1940, **13** (4), 17–18.

- GARNER, F. H.
Light Work Will Not Hurt Mares in Foal.
Fmrs' Wkly. 1940, **12** (17), 33.
- GARNER, F. H.
Rye, the Cereal for Sandy Soils.
Fmrs' Wkly. 1940, **13** (12), 29.
- GARNER, F. H.
Silage from Salvage.
Dairy Fmr. 1940, **13** (9), 13-15.
- GARNER, F. H.
Two Examples of Land Reclamation in East Suffolk.
4th Oxford Fmg Conf. 1939, 106-117.
- GARNER, F. H.
The £2 Ploughing Grant. Experiences on Suffolk's Derelict Areas.
Fmrs' Wkly. 1939, **10** (25), 22-23.
- 589* GARNER, F. H. & SANDERS, H. G.
Grass Silage.
Agriculture : J. Minist. Agric. 1939, **46**, 57-62.
Rep. Cent. Coun. Milk Rec. Soc. 1938, 50-53.
- 582* GARNER, F. H. & SANDERS, H. G.
The Spacing of Sugar-beet.
J. Minist. Agric. 1939, **45**, 1198-1201.
- HUNTER, H.
Varieties of Cereals for Autumn Sowing.
Agriculture : J. Minist. Agric. 1940, **47**, 127-129.
- MANSFIELD, W. S.
Alternate Husbandry.
J. Auct. & Estate Agents Inst. 1939, **19**, 1-11.
- MANSFIELD, W. S.
Best Market for Horses.
Fmr & Stk-Breed. 1940, **54**, 1084.
- MANSFIELD, W. S.
Fat Horses Cannot Work.
Fmr & Stk-Breed. 1940, **54**, 812.
- MANSFIELD, W. S.
Lessons from the 1939-40 Ploughing-up Campaign. II. East Anglia.
Agriculture : J. Minist. Agric. 1940, **47**, 95-96.
- MANSFIELD, W. S.
Quality Should Come First.
Fmr & Stk-Breed. 1940, **54**, 1134.
- MANSFIELD, W. S.
Summer Fallowing on Heavy Land.
Agriculture : J. Minist. Agric. 1940, **47**, 37-43.
- MANSFIELD, W. S.
The University Farm, 1938.
Camb. Univ. Agric. Soc. Mag. 1939, **6** (1), 5-9.
- MANSFIELD, W. S.
Will Heavy Horses be Wanted?
Fmr & Stk-Breed. 1940, **54**, 1038.

SANDERS, H. G.

Breaking Up Heavy-land Pasture.

Fmr & Stk-Breed. 1939, 53, 1427.

SANDERS, H. G. & GARNER, F. H.

Ruminations on Grass Silage.

Cambr. Univ. Agric. Soc. Mag. 1939, 6 (1), 39-40.

AGRICULTURAL ECONOMICS.

Changes in the Economic Organization of Agriculture—A Comparative Study of Conditions in the Eastern Counties of England in 1937 and 1938.

Fm Econ. By. Rep. No. 27. Pp. iv + 48. Price 1/6 net. Postage 2d.

The year 1938 was the most unprofitable one recorded in these surveys since 1932. Net returns averaged some 12/- per acre less than in 1937, and nearly 20/- per acre less than in 1936. A decline in profits is recorded for three of the four "type of farming districts" here dealt with, being most pronounced on the lighter soils. The factors contributing to this deterioration are complex.

The decrease in profits is due more to a reduction in gross incomes than to a rise in gross charges. On the income side there have been declines in the gross receipts from cattle, pigs, poultry, sheep, barley, sugar beet, "other crops" and miscellaneous, while there have been increases in dairy produce and wheat. On the expenditure side there have been rises in rent, fertilizers, seeds, implements and machinery, oil and coal, tackle hire and miscellaneous, and falls in labour, foods, livestock and "other transport". On the average gross incomes have fallen by 4 per cent and gross charges have risen by 1 per cent.

The changes in gross incomes have been caused partly by alterations in unit prices, and partly by both quantitative and qualitative changes in the goods sold. Unit prices fell substantially in the case of sheep, barley and potatoes, but rose for milk. The quantity of milk sold in 1938 was less than in 1937, while the "output" (measured in numbers) of cattle, pigs, poultry and eggs also declined. There was some increase in the sheep output, but collectively the quantitative output of all livestock and livestock products (weighted by 1937 unit prices) fell by 10 per cent. The output of wheat increased by nearly 50 per cent, while that of barley and oats showed a similar rise. The output of sugar beet, however, fell by 25 per cent, and the output of hay fell by over 50 per cent. For all the 1938 crops together the quantitative output (weighted by 1937 unit prices) increased by approximately 25 per cent. Together, the quantitative output of crops and livestock in 1938 was roughly 5 per cent greater than in 1937. Although the aggregate quantitative output thus appears to have risen, the value of the output fell.

The number of workers on these farms in 1938 was 5 per cent less than in 1937, but the cost per employee increased by 4 per cent. The quantity of feeding stuffs purchased declined by 3 per cent but the unit cost rose by 2 per cent. Considerable substitution occurred in the types of foods purchased. There was a substantial increase in the quantity of fertilizers bought, chiefly under the headings of basic slag and lime.

572* CARS LAW, R. McG.

Farm Organization and the Productivity of Labour.

4th Oxford Fmg Conf. 1939, 25-38.

591* CARS LAW, R. McG. & GRAVES, P. E.

Farm Organization on the Silt Soils of Holland, Lincolnshire.

J. R. Agric. Soc. 1938, 99, 54-76.

The Fen district around the Wash extends to about 800,000 acres of which about 450,000 consist of silts and 350,000 of peats. The present survey deals with farm organization on the silt soils in 1937. Capitalization, employment and output per acre are here much more important than in the neighbouring upland districts. The capital value of farm livestock, crops and equipment averages nearly £24 per acre, of which £15 per acre is invested in crops, £5½ in livestock and £3½ in equipment, while employment is at the rate of 6 workers per 100 acres.

The gross income averaged £18½ per acre of farmed land, or £27½ per acre of arable. Crops were the principal source of revenue, accounting for roughly 75 per cent of the total income. Potatoes were by far the most important crop and accounted for about 40 per cent of the total. The next most important items were sugar beet and wheat, each of which represent about 13 per cent of the gross income.

Expenses on the silt farms averaged £15½ per acre of farmed land, or £22 per acre of arable. Labour, which was the principal item of cost, averaged 100/- per acre (excluding occupier's labour). The rent, including the tenant's share of drainage rates, averaged 70/- per acre. Owing to the fact that a relatively small proportion of the farmed land is under fodder crops, expenditure on purchased foods was high—50/- per acre, while expenditure on fertilizers averaged 30/- per acre of farmed land, or 40/- per acre of arable.

GRAVES, P. E.

Tractor Costs.

Fm Econ. 1940, 3, 94–96.

MENZIES-KITCHIN, A. W.

Time Period Comparisons of Pig Costs and Profits.

Fm Econ. 1939, 3, 2–4.

620* PETTIT, G. H. N.

Farm Management Enterprise Studies.

J. Agric. Econ. Soc. 1940, 6, 56–68.

This paper is a critical discussion of the technique of farm management enterprise studies, of the type of information made available, and of the uses, proper and improper, to which that information may be put. The more important points discussed are: collection of data, analysis and interpretation for advisory and research purposes, practical applications to the improvement of technical efficiency (illustrated by reference to the *Cambridge Food Recording Scheme for Dairy Cows*) and severe limitations for the improvement of economic efficiency and as an aid to price-fixing.

A discussion, pp. 68–73, follows the paper.

PETTIT, G. H. N.

Dairy Farming as it Stands To-day.

Field. 17 February, 1940.

PETTIT, G. H. N.

Grazing Contrasts : A Comparison of 1937 and 1938 Summer Feeding and Grazing Costs of 69 Dairy Herds in the Eastern Counties.

Fm Econ. 1939, 3, 22–26.

Mainly owing to differences in rainfall, grazing conditions in the Eastern Counties were not nearly so good in 1938 as in 1937. In the identical sample of sixty-nine dairy herds milk yield per cow was maintained, but the cost of grazing per cow rose by 22 per cent, and the consumption of supplementary foods per cow by 25 per cent. Nevertheless, even in 1938 grazing was a comparatively cheap source of food.

622* PETTIT, G. H. N.

Labour in the Cowshed.

J. R. Agric. Soc. 1939, 100, (2), 46–55.

657*

Wastage, Length of Productive Life, Replacement and Depreciation of Dairy Cows.

J. Agric. Sci. 1940, 30, 485–497.

Both papers are based upon information and experience obtained in the operation of an advisory enterprise cost-accounting service to milk producers in the Eastern Counties. Discussion of the data, which were collected during the period 1934/5 to 1936/7, is largely in quantitative terms.

Average labour input per cow was 242 hours (£8 18s.) yearly, equivalent to 0·36 hours (3·0d.) per gallon, and is at a 10 per cent lower level during the summer grazing period than during the winter. It is affected by factors such as milk yield per cow and size of herd, which can be measured,

and by others such as differences in layout of buildings, in cowmen and in managerial skill, which cannot readily be expressed quantitatively. The cost of running a milking machine and the economics of machine-milking are discussed in detail.

In milk recorded herds, average length of productive *herd* life is 3·4 years and average length of *total* productive life is probably a little over 4 years. Average length of *total* productive life in all herds is probably longer and may be of the order of 5 years. Wastage and replacement are discussed in detail with special reference to their seasonal nature and to the distribution through the year of calvings. Cost of depreciation averaged £3 5s. per cow per year, equivalent to 1·1d. per gallon ; it is affected by level of milk yield.

SANDERS, H. G.

Cropping with an Eye to Labour.

Fmr & Stk-Breed. 1939, 53, 2709.

VENN, J. A.

Agriculture and the State.

Contribution to *Agriculture in the Twentieth Century*. Pp. 21-49. Cambridge Univ. Press, 1939.
Price 15s.

AGRICULTURAL ENGINEERING.

CULPIN, C.

Agricultural Engineering in North America and Germany.

Pp. xii + 162. (*College of Estate Management, London.* 1939. Printed for private circulation).

This book contains an account of (1) methods of education and research in agricultural engineering in North America and Germany, (2) current research in agricultural engineering, special attention being paid to studies that might have application in Britain, and (3) new farming implements, equipment and methods that might be of value in British farming.

CULPIN, C.

The Farm Motor Lorry.

Fmr & Stk-Breed. Yearb. 1939, 160-161.

CULPIN, C.

Implements to Save Time and Labour.

Fmr & Stk-Breed. 1940, 54, 245.

CULPIN, C.

Speed in the Hayfield.

Fmr & Stk-Breed. 1939, 53, 1144.

AGRICULTURAL ZOOLOGY (including Entomology).

PETHERBRIDGE, F. R.

Sugar Beet Pests.

Ann. Appl. Biol. 1939, 26, 397-399.

Black Bean Aphis : Aphis (Doralis) Fabae Scop.

This nomenclature is now used for the aphis which attacks beans and sugar-beet and the name *A. (Doralis) rumicis* is used for the non-migratory species which lives on Rumex.

Morphological differences between oviparous forms of *A. fabae* and *A. rumicis* are given.

An account of the biology of *A. fabae* in 1938 is given.

Experiments with various contact insecticides showed that nicotine dust gave the best control on the sugar-beet seed crop. Observations suggest that there is no economic method used at present in this country for the control of aphis on the ordinary sugar-beet crop.

Wireworms. In experiments carried out in 1937 the drilling of wheat between the rows of sugar-beet prevented the sugar-beet seedlings from attack by wireworm.

In 1938 sugar-beet proved a satisfactory crop in a number of fields where old grassland has been ploughed up in spite of the presence of a fairly high wireworm population.

Beet eelworm (*Heterodera schachii* Schmidt).

The present known distribution in England of this pest is shown. Various rotations are suggested for checking this pest.

PETHERBRIDGE, F. R., JONES, D. P., & JONES, F. G. W.

Investigations on Sugar-beet Pests in England in 1938.

Minist. Agric. Sug. Beet Res. & Educ. Comm. Paper No. 13. (Not available for general circulation).

The bean aphid (*Aphis rumicis*) was by far the most noticeable pest of the year and sugar-beet suffered the worst attack since 1911. Topping and dusting experiments show how this pest can be controlled on the beet seed crop. Observations suggest that the machines at present available are not satisfactory for the control of this aphid on the ordinary beet crop. Observations on egg laying led to the suggestion that this would not be a serious pest in 1939.

Experiments on wireworm suggest that sugar-beet is a satisfactory crop to take immediately following the breaking up of old grassland where the wireworm population is below 500,000 per acre.

Results of the sugar-beet eelworm survey (with maps) are given and a new method for counting eggs is described.

PETHERBRIDGE, F. R., JONES, D. P. & JONES, F. G. W.

Investigations on Pests of Sugar Beet in England in 1939.

Sug. Comm. Sug. Beet Res. & Educ. Comm. Commun. A, Paper No. 32. (Not available for general circulation).

In the Eastern Counties, the bean and beet aphid (*Aphis fabae*) was much less abundant than usual—a striking contrast to the previous year, when sugar beet suffered one of the worst attacks on record. Investigations on wireworms showed that increasing the seed rate and inter-drilling with wheat may be relied upon to give a measure of control. Evidence was collected to prove that the most serious damage by wireworms is to be expected in the second year after ploughing up grassland. A rough indication was obtained of the extent of damage produced by different populations of wireworms. Pigmy mangold beetle caused more damage than in the previous two years. There were local outbreaks of beet carrion beetle (*Bitophaga opaca*) and silver Y moth. An important step was taken to restrict the spread of the beet eelworm. By arrangement with the factories, infected areas were formally delimited and designated as "sugar beet eelworm infected areas", the administration of any one area being assigned to one particular factory. In this way it was hoped to facilitate the application of cropping restrictions already in force. The root knot eelworm (*Heterodera marioni*) was recorded on beet in this country for the first time. Other pests were of little importance.

564* WRIGHT, D. W.

The Control of Cabbage Root Fly (*Delia [Hylemia] brassicae*, Bouché).

J. Minist. Agric. 1938, **45**, 812-820.

Experiments suggest that root maggot on *Brassica* plants can be most effectively controlled by two applications of a 4 per cent calomel dust. On early transplanted *Brassicae* on light soils in the Eastern Counties the first application should be put on at the beginning of the last week of April followed by a second application some fourteen days later. On the heavier soils in this area these operations could, with little risk, be delayed an additional week. *Brassicae* transplanted later in the year should receive the first treatment within four days of setting out, preferably on the second or third days.

635* WRIGHT, D. W.

The Control of Cabbage Root Fly.

Agriculture : J. Minist. Agric. 1940, **46**, 765-772.

An account is given of the life history and damage caused by the cabbage root fly. Experiments showed that attack can be prevented by applying to the soil round the base of the plant a dust

containing 4 per cent of calomel. In trials with early cauliflowers and brussels sprouts treatment improved the yield and quality of the crops by as much as 83 per cent and 184 per cent respectively. Recommendations are given for the treatment of various brassica crops.

614* WRIGHT, D. W.

The Control of Onion Fly (*Delia [Hylemyia] antiqua Meig.*).

Agriculture : J. Minist. Agric. 1939, **46**, 147-154.

Calomel applied to onion seed before sowing, at the rate of 1 lb. per lb. of seed, effectively controls heavy onion fly infestations. Similar results can be obtained by two applications of 4 per cent calomel dust applied along the rows after germination.

Onion fly in leeks can be controlled by treating the seed with calomel before sowing.

Calomel-treated onion seed, sown directly after treatment, gives a better germination than untreated seed. This superiority is maintained during storage if the container used is of wood, cardboard or paper. If stored in closed glass or metal containers, however, the viability of treated seed is reduced and the sample is soon killed.

OTHER PAPERS.

PETHERBRIDGE, F. R.

The Beet and Bean Aphis.

Brit. Sug. Beet Rev. 1940, **14**, 6.

PETHERBRIDGE, F. R.

The Bean and Beet Aphis (*Aphis fabae*, Scop.).

Husbandry. 1939, **9**, 54-55.

PETHERBRIDGE, F. R.

The Control of Bean and Beet Aphis.

Brit. Sug. Beet Rev. 1939, **13**, 73-74.

PETHERBRIDGE, F. R.

The Control of Codling Moth and Apple Sawfly.

Horticulture. 1939, **2**, 31-33.

PETHERBRIDGE, F. R.

Seasonal Notes on Sugar Beet Pests.

Brit. Sug. Beet Rev. 1939, **13**, 109-110.

PETHERBRIDGE, F. R.

The Sugar Beet Eelworm.

Brit. Sug. Beet Rev. 1939, **13**, 171-172.

PETHERBRIDGE, F. R.

Sugar Beet Pests.

Brit. Sug. Beet Rev. 1939, **13**, 13-14.

PETHERBRIDGE, F. R.

Sugar Beet Eelworm. Control Measures.

Brit. Sug. Beet Rev. 1939, **13**, 217-218.

PETHERBRIDGE, F. R.

The Sugar Beet Eelworm Menace.

Brit. Sug. Beet Rev. 1939, **13**, 139-140, 200-201.

PETHERBRIDGE, F. R.

Sugar Beet on your Ploughed-up Grassland.

Brit. Sug. Beet Rev. 1940, **13**, 287.

WARBURTON, C.

Annual Report for 1938 and 1939 of the Zoologist.

J. R. Agric. Soc. 1938, **99**, 542-547; 1940, **100** (3), 139-141.

WRIGHT, D. W.

Calomel Kills Cabbage Root Fly.
Fmr & Stk-Breed. 1940, **54**, 988.

WRIGHT, D. W.

The Control of Lettuce Aphis.
Fruit-Gv. 1939, **88**, 539-540.

ANIMAL BREEDING AND GENETICS.

602* DAY, F. T.

Some Observations on Causes of Infertility in Horse Breeding.

Vet. Rec. 1939, **51**, 581-587.

A summarized account of the various abnormal conditions of mares and stallions causing temporary or permanent sterility. Treatment of different cases of sterile mares shows that mares sucking air through the vulva can be successfully treated by an operation in which the upper commissure of the vulva is closed by suturing the lips of the vulva together. Cystic ovaries and irregularities of the oestrous cycle can be corrected either by puncture of ovarian cysts or by the injection of gonadotrophic hormones.

In mares which were apparently normal but had remained sterile several years, artificial insemination with sperm collected from stallions by using an artificial vagina proved successful.

A table given at the end of the paper shows the volume, density and motility of sperm collected from 19 different stallions of all grades of fertility.

DAY, F. T.

The Stallion and Fertility : the Technique of Sperm Collection and Insemination.

Vet. Rec. 1940, **52**, 597-602.

The technique of sperm collection is described. With service intervals of 6 hours to a week the fertility of stallions was good when the numbers of sperm in the ejaculate were from 4,000 to 10,000 millions ; fertility declined when the numbers of sperm fell below 2,000 millions. Fertility appeared to depend on total number of active sperms ; small numbers of abnormal sperms had no bearing on fertility. The amount of vesicular fluid in any ejaculate was very variable, but is of no importance for fertility. One collection of sperm may be sufficient to pronounce a stallion of good fertility, but several collections should be made before condemning a horse as of low fertility.

EDWARDS, J. & WALTON, A.

Criteria of Fertility in the Bull. Results of Correlating Sperm Characteristics in Periodic Tests with Service Records.

C. R. Congr. Int. Zootech. Zürich, 1939. 260.

Samples of the semen of fifteen bulls were taken at fortnightly intervals by means of the artificial vagina. The volume, density and total number of spermatozoa were measured. As a measure of sperm activity the initial rate of oxygen consumption of the semen in a Barcroft-Dixon respirometer was taken. The values obtained from these measurements were correlated with the service records (services per conception) of the bulls. Some correlation was observed between activity and high fertility; no correlation was observed for the other characteristics. It is concluded that the activity of the spermatozoa is the best criterion of male fertility.

561* EDWARDS, J. & WALTON, A.

A New Service-crate.

Emp. J. Exp. Agric. 1938, **6**, 206.

A breeding crate is described which can be used for regular collections of semen from bulls. As the cow is firmly held in the crate she need not be in oestrus. Purposes for which the crate is useful are semen collections for artificial insemination and fertility tests, for bulling young heifers with a heavy sire and for blood tests, etc. of excitable cows.

EDWARDS, J. & WALTON, A.

Problems of Semen Production Related to Artificial Insemination.

7th Int. Genet Congr. Edinburgh.

Abstr. & Disc. in *Animal Breeding in the Light of Genetics.*

Imp. Bur. Anim. Breed. & Genet., Edinburgh. 1939. 30-31.

571* HOWARD, H. W.

Genetics of *Armadillidium vulgare* Latr.

Nature. 1938, **142**, 1038.

The red variety of this woodlouse behaves as a dominant to the commoner black types. One brood contained 36 females but only one male.

651* HOWARD, H. W.

The Genetics of *Armadillidium vulgare* Latr. I. A General Survey of the Problems.

J. Genet. 1940, **40**, 83-108.

A number of varieties of this woodlouse have been shown to be dominant genetically to the common black type. Peculiar sex ratios are also found in broods from some females—some broods consist of males only, others entirely of females.

625* HOWARD, H. W.

Monogenic Broods in *Armadillidium vulgare* Latr.

Nature. 1939, **144**, 979.

It is shown that in this woodlouse the male has no effect on the sex ratio of the brood, the type of brood being determined by the female parent.

641* MCMEEKAN, C. P. & HAMMOND, J.

The Relation of Environmental Conditions to Breeding and Selection for Commercial Types in Pigs.

Emp. J. Exp. Agric. 1940, **8**, 6-10.

Abst. and Disc. in *Animal Breeding in the Light of Genetics*. Imp. Bur. Anim. Breed. & Genet., Edinburgh. 1939. 63-65.

Rapid early growth and slow later growth intensifies the early-developing tissues (skeletal framework and muscle), and inhibits the later-developing tissues (subcutaneous fat), thus producing the bacon type. Slow early growth and rapid later growth has exactly the opposite effect, and produces the lard type.

By controlling the nutritional environment so as to develop the desired character (muscular development or subcutaneous fat) to its physiological limit, it is possible to make proper genetic selection.

The way to improve our domestic animals for production is, therefore, to place them in the optimum environment for developing the desired character, and to select, preferably by the progeny test, those which develop that character to the fullest extent.

The bacon and the lard types of pig differ mainly in the intensification of the early skeletal and muscular phase of growth in the former and the intensification of the subcutaneous fatty phase of growth in the latter. These two types are produced commercially under quite different systems of farm management.

Within litters from the same inbred strain of Large White pigs, individuals were made to grow according to growth-curves of predetermined shapes by controlling the plane of nutrition at different stages of growth.

PINCUS, G.

The Comparative Behaviour of Mammalian Eggs *in vitro*. IV. The Development of Fertilized and Artificially Activated Rabbit Eggs.

J. Exp. Zool. 1939, **82**, 85-129.

A description is given of methods of superovulating rabbits with pituitary preparations; twelve to one hundred eggs per female were obtained. Treatment with the sperm of the bull, ram, etc. rarely results in activation, and these foreign sperm do not penetrate the rabbit ova. Ovarian ova and unfertilized tubal ova are activated to varying degrees by treatment *in vitro* with hypertonic solutions, supranormal temperatures, etc. Haploid, diploid or tetraploid parthenogenesis results from the treatments employed, but in many cases atretic processes arrest development of activated eggs at various stages of development. Ova artificially activated *in vitro* were transplanted to the fallopian tubes of pseudo pregnant females; of nineteen females receiving activated ova three produced young at term.

637* PUNNETT, R. C.

Genetic Studies in Poultry. X. Linkage Data for the Sex Chromosome.

J. Genet. 1940, **39**, 335-342.

565* THOMASSET, L. F.

A Study of the Development of the Characters of the Fleece during Growth in the Different Regions of the Body.

J. Agric. Sci. 1938, **28**, 523-540.

A study has been made of the relative development of some regions in the fleece of twin lambs of a Suffolk ♂ × Suffolk (Border Leicestershire-Cheviot) ♀ cross during growth. The different regions develop in the following order: shoulder → leg → belly → tail. It is concluded that an improved animal is one in which the latest developing part of the fleece has the least possible number of undesirable fibres at the earliest possible age. The breeds of sheep begin their wool improvement by changes in the earliest developing regions (shoulder) and finish it in the latest (tail).

The properties of the fleece studied were the colour of the fibres, the medullated fibres, the fineness of the fibres, and uniformity of fibre size. In general a relationship is found between the stage and rapidity of development of the area, and the properties of the fibre. The intensity of the colour is stronger during the early active stages of development. There is a tendency to lose some kinds of coloured fibres, and to diminish the intensity of the colour in others as the development of each region in which the fibres grow proceeds.

The medullated fibres appeared in greatest quantities in the later developing regions, except the belly which presents few medullated fibres.

The staple is much finer at the first month of growth than in the later stages. Frequency curves of fibre size are of more value than average fibre size in estimating the value of the fleece.

It is suggested that the examination of the fleece of the lamb will give some idea of its genetic constitution and will reveal defects which would be concealed in the adult. Such a "pheno-genetic" selection can be made best in a "late developing" area of the body such as the tail of the lamb at one month old.

587* WALTON, A.

Preservation of Fertilizing Capacity of Horse Semen.

Proc. Amer. Soc. Anim. Prod. 1938, **31**, 238-241.

Fertile inseminations were obtained with spermatozoa which had been twice diluted and concentrated by centrifuging and which was stored for 24 hours at 0°C. No fertile inseminations were obtained with spermatozoa stored for 48 hours.

606* WALTON, A.

The Quantitative Basis of Fertility.

Folia Morph. 1938, **8**, 270-280.

The large number of spermatozoa which are normally ejaculated by the male is not greatly in excess of the number required to ensure fertility, since the chances of any one spermatozoon reaching the site of fertilization at a time when a fertilizable ovum is present is extremely small. The chances of fertilization depend upon several factors of which the chief are (1) the number of spermatozoa, (2) their activity and viability, and (3) the efficiency of the mechanism by which the spermatozoa are transported to the site of fertilization. Fertility is therefore a quantitative relationship and to be measured in terms of the statistical probability of a viable spermatozoon meeting a fertilizable ovum. Within physiological limits there may be a complete gradation between fertility and sterility according as the probability varies.

WALTON, A.

Respiratory Activity of the Spermatozoon as an Index of Activity and Fertilizing Capacity.

Atti Ia Ad. Naz. Vet. Fecond. Artif. (Celebrazioni Spallanzaniane. Pavia, 1939).

The respiratory activity (oxygen uptake) of a series of samples of bull semen was measured in a Barcroft-Dixon differential manometer. The respiratory activity was found to be closely correlated with the fertility of the individual bulls.

588* WALTON, A. & EDWARDS, J.

Criteria of Fertility in the Bull. I. The Exhaustion Test.

Proc. Amer. Soc. Anim. Prod. 1938, **31**, 254-259.

Thirteen bulls under similar management were subjected to an "exhaustion" test of the semen. From each bull ten samples of semen were collected within a period of two hours by means of the artificial vagina. The samples were measured for volume, density, total number and respiratory activity in a Barcroft-Dixon manometer. The results were compared with the breeding records of the bulls. There was no definite correlation between fertility (services per conception) and volume, density and total number but a definite correlation between services per conception and respiration rate.

643* WALTON, A., EDWARDS, J. & HAMMOND, J.

Fertility in Farm Animals.

J.R. Agric. Soc. 1940, **100** (3), 1-12.

A review of present day knowledge of fertility and sterility with special reference to physiological causes. Separate sections are devoted to horses, cattle, sheep and pigs. Original data on fertility in bulls and methods of diagnosing sterility are given. Reference is made to the use of artificial insemination in cattle.

OTHER PAPERS.

EDWARDS, J.

An Experiment in In-Breeding.

Fmr & Stk-Breed. 1939, **53**, 598.

GARNER, F. H.

Breeding Problems on the Dairy Farm.

Fmrs' Wkly. 1940, **12** (3), 34.

HAMMOND, J.

Fertility in Sheep.

Agriculture : J. Minist. Agric. 1940, **47**, 116-124.

605* HAMMOND, J.

Impressions of Pig Breeding in the Antipodes.

Pig Breed. Annu. 1939/40, **19**, 50-55.

HAMMOND, J.

Speeding Up Wartime Sheep Breeding.

Fmr & Stk-Breed. 1940, **54**, 1741.

MANSFIELD, W. S.

Breeding of Farm Animals.

Husbandry. 1939, **9**, 47-49.

PEASE, M. S.

Auto-Sex Linkage.

Poult. Ind. 27th Nov., 1938, 7-9.

PEASE, M. S.

Auto-Sex Linkage Breed Warning.

Feath. World. 1939, **101** (2615), 14.

PEASE, M. S.

Autosex-Linkage in Geese.

Feath. World. 13th Jan., 1939.

PEASE, M. S.

How to Breed from Cross-bred Sex Linked Pullets.

Feath. World. 1940, **102** (2644), 12.

- PEASE, M. S.
Best to Breed from Pullets.
Feath. World. 1939, **100** (2598), 6.
- PEASE, M. S.
The Dorbar.
Feath. World. 1940, **103** (2663), 9.
- PEASE, M. S.
Early Mortality and Its Inheritance.
Fmr & Sth-Breed. 1939, **53**, 357.
- PEASE, M. S.
How to Make New Autosex-Linkage Breeds.
Poult. Keep. Yearb. 1938, 223-224.
- PEASE, M. S.
Inbreeding and Stamina.
Feath. World. 2nd Dec., 1938.
- PEASE, M. S.
Poultry at the International Genetics Congress.
Feath. World. 1st Sept., 1939.
- PEASE, M. S.
Progeny Testing to Improve Egg Yield.
Feath. World. 1939, **100** (2600), 13.
- PEASE, M. S.
Simple Mendelism.
Poult. Keep. Yearb. 1938, 220-222.
- 645* PUNNETT, R. C.
Contributions of Genetics to the World's Poultry Industry.
7th World's Poult. Congr. 1939, 145-148.

ANIMAL NUTRITION.

- 654* CRUICKSHANK, E. M.
The Chemical Composition of the Egg.
Chem. Ind. 1940, **59**, 415-419.
 This paper formed a contribution to the discussion on the food value of the egg held at a meeting of the Food Group of the Society of Chemical Industry.
 The protein, fat, vitamin and mineral constituents of the egg and their distribution between yolk and white are discussed in detail. The extent to which the dietary regime and management of the hen may affect the composition and nutritive properties of the egg is indicated.
- 624* CRUICKSHANK, E. M.
The Effect of Cod Liver Oil and Fishmeal on the Flavour of Poultry Products.
7th World's Poult. Congr. 1939, 539-542.
 Repr. in *U.S. Egg & Poult. Mag.* 1939, **45**, 752-754, 762-764.
 Two per cent of cod liver oil in the fattening ration or 2 per cent cod liver oil plus a 15 per cent level of high grade fishmeal fed for a six month period up to the time of killing was without detrimental effect on the flavour of carcasses, either fresh or stored, of Light Sussex chickens.
 A 15 per cent level of low grade fishmeal (fat content 20 per cent) plus 2 per cent cod liver oil fed for a four week or six month period up to killing, produced a slight fishy flavour in a few of the fresh carcasses, though not in the stored carcasses. Individual differences in the development of fishy flavour on the same ration appear to exist.
 Eggs from the birds fed the higher levels of fishmeal plus 2 per cent cod liver oil were more susceptible to fishy taint than were the carcasses, especially with fishmeal of poor quality.
 Prolonged feeding of rations containing fish oils causes an increase in the degree of unsaturation of both body fat and yolk fat.

623* CRUICKSHANK, E. M., HOUSTON, J. & MOORE, T.

The Effect of the Dietary Fat on the Body Fat and Egg Fat of the Hen.

Biochem. J. 1939, **33**, 1630–1634.

Fatty acids from the egg and abdominal fats of hens given diets with no added oil, or with the inclusion of sperm oil or linseed oil, contained polyethylenic acids in the "pro-absorptive" state.

The dietary fat had a marked effect on the amount of polyethylenic acids present in the egg fat as revealed by spectroscopic examination after refluxing with KOH. Similar effects were observed for the abdominal fat.

With sperm oil added to the diet the increases of absorption after refluxing with KOH were about equally great at 230 and 270 m μ . With the diet free from fat, and with linseed oil included, the increase in absorption at 230 m μ was greater than at 270 m μ .

The inclusion in the diet of tung oil which absorbs intensely at 270 m μ caused a marked increase in the preformed spectroscopic absorption at 230 m μ in the egg and the body fatty acids. This change in the position of the absorption maximum is probably to be ascribed to the loss of one of the conjugated unsaturated linkages of elaeostearic acid.

The above results suggest that there are marked differences in the treatment of polyethylenic acids by the cow and hen.

616* DEIGHTON, T.

A Study of the Metabolism of Fowls. I. A Calorimeter for the Direct Determination of the Metabolism of Fowls.

J. Agric. Sci. 1939, **29**, 431–451.

A description of the construction of the poultry calorimeter in use at the Animal Nutrition Institute, Cambridge, is given, together with particulars of comprehensive tests of performance under various conditions. It is shown that the instrument is excellently adapted to the measurement of a rapidly varying heat output and that such a quality is of first importance in work on the metabolism of fowls.

633* DEIGHTON, T. & HUTCHINSON, J. C. D.

Studies on the Metabolism of Fowls. II. The Effect of Activity on the Metabolism.

J. Agric. Sci. 1940, **30**, 141–157.

The diurnal rhythm of heat production in fasting Light Sussex cockerels was measured in a direct calorimeter. The effect of variation of the visible activity was excluded (a) by artificial stimulation in the night periods and (b) by recording the activity under these conditions by a system of point scores, and reducing the heat production to zero activity by means of regression equations. The rhythm was found to be about 9 per cent.

The energy quota for various activities of the bird was measured. The heat production in the standing position was 40–45 per cent above that in the sitting position, a figure considerably in excess of the increase for standing over lying usually found in quadrupeds.

658* DEIGHTON, T. & HUTCHINSON, J. C. D.

Studies on the Metabolism of Fowls. III. The Determination of the Comparative Nett Energy of Sussex Ground Oats and White Maize Meal for Fattening Cockerels.

J. Agric. Sci. 1940, **30**, 463–484.

The comparative net energy for fattening of Sussex ground oats and white maize meal have been determined on Light Sussex cockerels by difference experiments with a direct calorimeter.

The mean values for net energy per gram dry matter, net energy/metabolizable energy, metabolizable energy per gross feed energy and digestible energy per gross feed energy were as follows :

	Sussex ground oats	White maize meal
Net energy per gram dry matter	2·573 kg. cal.	3·048 kg. cal.
Net energy \div metabolizable energy	83·0%	82·1%
Metabolizable energy \div gross feed energy	65·4%	79·5%
Digestible energy \div gross feed energy	67·2%	81·3%

There was no significant difference in the utilization of metabolizable energy from the two cereals. The higher net energy of the white maize meal was due to its higher digestibility.

567* GARNER, F. H. & SANDERS, H. G.

A Study of the Effect of Feeding Oils to Dairy Cows and of the Value of the Latin Square Lay-out in Animal Experimentation.

J. Agric. Sci. 1938, **28**, 541-555.

A description is given of an adaptation of the Latin square lay-out to experiments with dairy cows. Experiments were conducted to test the effect of adding various fats and oils to the ration, and since effects were rapidly produced the Latin square technique proved very efficient, experimental errors being rather lower than those usually obtained in experiments with crops.

Seventeen separate experiments, including in all, twenty-one different cows (many of whom were used more than once), were conducted; fourteen of these were short-term experiments with unit periods of 5 days, two were medium-term with unit periods of 10 days, and one long-term with 20 days.

Palm oil, butter, lard and possibly cotton-seed oil were found to increase butterfat yield, chiefly by raising the butterfat percentage of the milk. Soya-bean, linseed and whale oils were without effect. Cod-liver oil definitely decreased butterfat percentage and butterfat yield.

It appears that the beneficial oils are those containing a large proportion of the saturated fatty acids.

Experiments with the same oil were not always consistent, and it appears that the effect may vary from cow to cow, and also with the same cow at different times.

646* HALNAN, E. T.

Some Observations on the Protein Requirements of the Laying Fowl.

7th World's Poult. Congr. 1939, 145-148.

Field and metabolic trials carried out with Light Sussex hens and pullets led to the following conclusions:

A high positive correlation exists between feed consumption and egg production.

A high positive correlation exists between live weight and feed consumption for maintenance. Protein of animal origin added to a cereal ration leads to an increase in egg production, but the conversion of feed protein to egg protein may be less efficient. Nevertheless, the increased monetary return from extra egg production may justify such a practice from the commercial point of view.

In the case of the Light Sussex breed, it appears that the daily digestible protein requirement for maintenance per pound of live weight is 0.625 g., and for the production of a 2-ounce egg, 12.5 g.

VERGÉS, J. B.

The Effect of Plane of Nutrition of the Ewe on Weight and Development of the Lamb at Birth.

C.R. Congr. Int. Zootech. Zürich, 1939. 317.

Pregnant ewes fed on a high plane of nutrition gained $39\frac{1}{2}$ lb. whilst ewes on low plane gained only 1 lb. (including uterine contents).

No significant difference was found in the weight at birth of single lambs. Twin lambs from high plane ewes were significantly (47.5 per cent) heavier than those from low plane ewes, and their average individual weight was practically equal to that of single lambs. Triplet lambs from high plane ewes were heavier than from low plane ewes.

The composition of lambs at birth was affected by the plane of nutrition of the ewe. The parts of the body growing most rapidly during the latter part of pregnancy (limbs) were affected more than the earlier growing ones (head).

The increased muscular development of the lambs from high plane ewes is due almost entirely to an increase in diameter of the muscle fibres.

595* VERGÉS, J. B.

Effect of the Plane of Nutrition on the Carcase Quality of Suffolk Cross Lambs.

Suffolk Sheep Soc. Off. Yearb. 1939, 27-37.

This paper summarizes the results of an experiment involving four different growth curves in lambs of 30 lb. carcass weight. The curves (High-High, High-Low, Low-High and Low-Low) were secured by altering the plane of nutrition. The changes in conformation and composition, as well as commercial adaptability in the four groups and the results of birth animals after differential feeding of the ewes, are illustrated and described.

WOODMAN, H. E.

The Feeding of Farm Live Stock.

Fmrs' Guide Agric. Res. 1937, 1938, 1939.

J. R. Agric. Soc. 1938, **99**, 283–322 : 1939, **100** (1), 94–132 : 1940, **101** (1), 95–124.

A record of current world research and its significance.

615* WOODMAN, H. E. & EVANS, R. E.

The Composition and Digestibility, When Fed to Pigs and Sheep, of Potato Cossettes and Potato Meal.

J. Agric. Sci. 1939, **29**, 347–363.

Pigs, subsisting on a ration containing about 34 per cent of potato meal, digested the potato product with a very high degree of efficiency. It may be concluded that potato meal, from the standpoint of pig feeding, is about equal to maize meal, slightly superior to barley meal and markedly superior to ground oats.

The digestibility of potato meal protein in the pig is low. This is due to a depression of the digestibility of the protein in the ration as a whole, occasioned by the presence of the potato meal.

Pigs are able to utilize the dried potato products more efficiently than sheep. From the standpoint of supply of digestible organic matter and starch equivalent in the feeding of ruminants, the dried potato products are somewhat inferior to barley meal, if the comparison be based on the assumption that the potato products and the barley meal have equal moisture contents. If, however, as is more likely to be the case in feeding practice, the barley meal contains about 14 per cent of moisture and the potato products only about 10 per cent, it is shown that the latter should be capable of replacing barley meal pound for pound, in the rations of sheep and cattle.

644* WOODMAN, H. E. & EVANS, R. E.

The Composition and Nutritive Value, When Fed to Ruminants, of Pea-pod Meal and Broad-bean-pod Meal.

J. Agric. Sci. 1940, **30**, 189–201.

The investigation was carried out on pea-pod and bean-pod meal that had been conserved in the factory by the method of artificial drying.

Both pea-pod meal and bean-pod meal have a very satisfactory digestibility, roughly two-thirds of the food material which they contain being capable of digestion by ruminants. On the basis of 10 per cent moisture content, pea-pod meal contains 54.8 per cent of starch equivalent, including 7.1 per cent of protein equivalent, the corresponding values for bean-pod meal being 53.6 and 8.0 per cent. Pea-pod meal is roughly one-and-a-half times as rich as medium meadow hay in starch equivalent and protein equivalent, and both meals are superior, in respect of starch equivalent, to the best grade of hay made from grass or leguminous crops. Examples of rations containing dried pea-pods have been computed to illustrate the considerable saving of hay and concentrates that becomes possible when this by-product, or pea-pod silage, is used in winter dietaries.

566* WOODMAN, H. E. & EVANS, R. E.

Nutritive Value of Pasture. XII. The Influence of Cutting at Monthly Intervals over Nine Seasons on the Quality and Productivity of a Heavy-land Pasture.

J. Agric. Sci. 1938, **28**, 581–591.

A permanent pasture on heavy clay soil has been submitted to cutting at monthly intervals over a period of nine seasons. During this period, varying weather conditions were experienced, from two consecutive seasons of extreme heat and drought to seasons of abundant and well-distributed rainfall. No deterioration of productivity, ascribable to the system of cutting, was noted on a number of plots submitted to different manurial treatments ; nor did the continuous cutting lead to any falling off in the quality of the herbage as judged from the standpoint either of chemical or of botanical composition. During the final season the plots averaged a yield of herbage equivalent to 3.86 tons of dried young grass (containing 10 per cent of moisture) per acre. The protein content of the grass, on the basis of dry matter, varied from 18.3 to 27.4 per cent.

566* WOODMAN, H. E. & EVANS, R. E.

Nutritive Value of Pasture. XIII. An Enquiry into the Residual Effects of the Intensive Use of Sulphate of Ammonia on Pastures.

J. Agric. Sci. 1938, **28**, 592-597.

The artificial stimulation of growth over a period of years by the use of sulphate of ammonia had reduced the inherent vigour of the grasses, so that they were unable, when the stimulus was no longer administered, to display as quick growth as grasses which had not been subjected to such stimulation. It was demonstrated, however, that the resumption at a later date of the use of sulphate of ammonia restored the affected areas to their original pre-eminence from the stand-point of yield.

566* WOODMAN, H. E., EVANS, R. E. & OOSTHUIZEN, P. M.

Nutritive Value of Pasture. XIV. The Influence on Yield and Composition of a Single Heavy Dressing of Sulphate of Ammonia Compared with that of Periodic Small Dressings Throughout the Season.

J. Agric. Sci. 1938, **28**, 598-603.

It was shown that a heavy dressing of sulphate of ammonia applied to grassland in February may cause, if the weather conditions are suitable, a very pronounced stimulation of early growth of unusually high protein content. Under these conditions, an entirely leafy first cut was obtained, containing, on the basis of dry matter as much as 30·6 per cent of crude protein. If the weather conditions are unsuitable during the period of their application, however, such early heavy dressings may cause very severe scorching and blackening of the herbage with the result that the yield during the first part of the season may be smaller than would have been obtained if the pasture had received only a moderate dressing. The suggestion is made that the best method of using this fertilizer on pastures in the southern half of England is to give a moderate dressing in February to encourage earliness of growth; another in late April to increase the rate of growth during the "flush" period of late May, and a third and perhaps smaller application to stimulate the secondary "flush" usually experienced in August.

575* WOODMAN, H. E., EVANS, R. E. & CALLOW, E. H.

The Nutrition of the Bacon Pig.

III. The Minimum Level of Protein Intake Consistent with Quick Growth and Satisfactory Carcass Quality (Part I).

J. Agric. Sci. 1939, **29**, 115-130.

Large scale feeding trials, with Large White pigs, have been carried out to study the influence on growth and carcass quality of feeding rations containing approximately the so-called standard amounts of protein-rich food as compared with that of rations containing only half the standard amounts.

Only in the earliest stage of the feeding period did the low-protein pigs show a slightly, though significantly, lower rate of live-weight increase and poorer efficiency of food conversion than the pigs on the standard protein treatment, but such differences ceased to be manifested by the time the pigs arrived at 60 lb. live-weight, and the slight initial disadvantage experienced by the low-protein pigs was wiped out during the later stages of the feeding period. Considering the period up to 200 lb. live-weight as a whole, the differences in feeding gave rise to no significant differences in respect either of mean rate of live-weight increase per day or of efficiency of food conversion.

It was found also that the low protein treatment gave rise to carcasses displaying no significant differences in conformation, leanness and general quality from those obtained by the use of rations containing the standard amounts of protein rich food.

621* WOODMAN, H. E. & EVANS, R. E.

Nutrition of the Bacon Pig.

IV. The Influence on Growth, Conformation and Carcass Quality of Including Meat Meals of Widely-differing Fat Content in the Rations of Bacon Pigs.

J. Agric. Sci. 1939, **29**, 502-523.

Two separate large-scale feeding trials have been carried out, at different periods of the year, to test whether the inclusion, in customary amounts in the rations of bacon pigs, of meat meals containing about 10 per cent of fat gives rise to the production of fatter carcasses with a softer type of fat than are obtained by the use of extracted meat meals containing only 2-3 per cent of fat.

Tests were also made with meat meals containing as much as 17–20 per cent of fat. The main question at issue was whether it is necessary to submit meat meals to extraction with petroleum benzine at 200°F. in order to obtain a product suitable for including in the rations of bacon pigs.

The feeding treatments containing the three different meat meals gave rise to no significant differences in the live-weight increase and the efficiency of food conversion. Nor were there any significant differences between the pigs in respect of carcass fatness as judged by the thickness of the back fat and the belly streak, the size and leanness of typical rashers and of the "eye" muscle, the weight of flare fat and the weight of the fillets.

Iodine values from samples of body fat taken from four different regions of the carcasses showed no significant differences due to feeding treatment. The findings discussed in this paper point clearly to the conclusion that meat meals of this composition, when included in the amounts employed in this investigation, give as good results as may be obtained from the use of extracted meat meals of very low fat content.

634* WOODMAN, H. E. & EVANS, R. E.
Nutrition of the Bacon Pig.

V. The Minimum Level of Protein Intake Consistent with Quick Growth and Satisfactory Carcase Quality (Part II).

J. Agric. Sci. 1940, **30**, 83–97.

This investigation is the sequel to an earlier pig-feeding trial (*J. Agric. Sci.* 1939, **29**, 115–130).

In the present trial a totally different form of protein supplement was used since the question of the biological efficiency of the protein supply might conceivably be of critical importance at the lower levels of protein feeding. The protein supplements were fed in conjunction with barley meal, weatings and a small allowance of lucerne meal.

The conclusions from the previous work were completely confirmed by this further investigation. The only significant differences were found in the earliest stage of the feeding period up to 90lb. live-weight. During this part of the trial, the pigs on the low level of protein-food intake showed a slightly, though significantly, lower mean rate of live-weight increase than the pigs receiving the standard amounts of protein food. This confirms the finding in the earlier trial that 5 per cent of white fish meal (or its equivalent) is slightly too low at this stage for maximum growth.

The pigs on the low levels of protein-food intake gave carcasses showing no significant differences in respect of leanness, conformation and general finish from those obtained from the pigs receiving the standard amount of white fish meal.

A subsidiary conclusion from the results of this trial is that the highly unsaturated oil in white fish meal, even when this food is used in no more than the standard amounts, may have a slightly softening effect on the carcass fat.

OTHER PAPERS.

CULPIN, C.

Feeding Stuffs May be Ground Coarser.
Fmr & Stk-Breed. 1938, **52**, 2417.

636* EDWARDS, J.

Feeds and Feeding Practice for Pigs During War-time.
Pig Breed. Gaz. 1940, **50**, 37–43.

HALNAN, E. T.

How to Cheapen the Ration.
Poul. Keep. Yearb. 1938, 169–172.

HALNAN, E. T.

Increased Food Production.
Times. 6 June, 1940.

GARNER, F. H.

Feeding in Yards or Stalls.
Fmr & Stk-Breed. Yearb. 1939, 113–114.

590* GARNER, F. H.

Less Protein is Needed.
Fmr & Stk-Breed. 1939, **53**, 941.

GARNER, F. H.

Preparing for Grassland Lambs.
Fmr's Wkly. 1940, **12** (5), 30.

GARNER, F. H.

Wheat in a Digestible Form.
Fmr & Stk-Breed. 1939, **53**, 1251.

GARNER, F. H.

Wheat is a Worth-while Food for Stock.
Fmr & Stk-Breed. 1939, **53**, 545.

WOODMAN, H. E.

Do Not Waste Protein.
Fmr & Stk-Breed. 1939, **53**, 614.

WOODMAN, H. E.

Farming and the War. III. Hay, Dried Grass, Silage: A Comparison.
Field. May, 1940.

WOODMAN, H. E.

From Guesswork to Science in Livestock Feeding.
Fmr's Wkly. 1939, **10** (26), 45.

WOODMAN, H. E.

Hints on Feeding.
Agriculture: J. Minist. Agric. 1940, **46**, 664–666, 733–737.

WOODMAN, H. E.

Notes on Feeding.
Agriculture: J. Minist. Agric. 1940, **47**, 32–36, 123–126.

WOODMAN, H. E.

The Use of Straw for Fodder.
Tech. Hort. & Publ. Div. Minist. Agric. Sept. 1940, (Mimeoographed).

ANIMAL PHYSIOLOGY.

647* DAY, F. T.

Clinical and Experimental Observations on Reproduction in the Mare.
J. Agric. Sci. 1940, **30**, 244–261.

The length of oestrus averages 7–8 days and varies from 3 to 54 days. The length of dioestrus in most cases is 11–16 days. Ovulation occurs in most cases on the last day of heat, but may occur on the 1st and 2nd days or even 5th day before the end of oestrus. Artificial insemination was effective 24–72 hours before ovulation, but was unsuccessful 2–4 hours after ovulation. Pregnancy was diagnosed by rectal palpation on the 23rd day in all mares and as early as the 16th day in one mare. Gonadotrophic hormones had no effect when given in the anoestrous period. Ovulation was induced in 20–40 hours in most cases after intravenous injection of 1,000–2,000 M.U. pregnancy urine hormone, provided a fairly mature follicle was present; when this was done the length of oestrus was shortened. Oestrus was induced by subcutaneous injection of 500–1,000 M.U. of P.M.S.¹ for 3 or more days. Horse pituitary extract in doses of 50–100 mg. induced oestrus and when given at the onset of oestrus hastened ovulation and shortened oestrus. The only mare mated in an induced oestrus became pregnant. Continued injection of gonadotrophic hormones did not have any deleterious effect on subsequent oestrous cycles or prevent them from becoming pregnant afterwards.

¹ P.M.S. = pregnant mare serum.

617* DAY, F. T.

The Oestrous Cycle of the Mare Following Removal of the Foetus at Various Stages of Pregnancy.

J. Agric. Sci. 1939, **29**, 470-475.

The technique employed for removal of the foetus and membranes from 7 Welsh pony mares is given. The stage of pregnancy was estimated by measurement of the recovered foetuses. The subsequent oestrous cycles of the treated mares were followed, showing that removal of the foetus had no detrimental effect on mares between the 51st and 105th day of pregnancy. The oestrous cycles of these mares did not appear to be influenced by the stage at which the foetus was removed.

618* DAY, F. T.

Ovulation and the Descent of the Ovum in the Fallopian Tube of the Mare after Treatment with Gonadotrophic Hormones.

J. Agric. Sci. 1939, **29**, 459-469.

In mares with a large follicle in the ovary, pregnancy urine extract given as an injection of 1,000 mouse units intravenously induced ovulation at any time in cycle.

In mares in oestrus at time of injection, ovulation occurred in 22 to 30 hours after injection and the length of oestrus was reduced from 7 and 9 days to 3 days. In mares not in oestrus when injected, ovulation occurred 30 to 60 hours after injection without the appearance of symptoms of oestrus. Normal ovulation occurred after these injections as was shown in the case of one mare from which the ovum was recovered from the uterine end of the fallopian tube some 95 hours after ovulation.

604* DAY, F. T.

Sterility in the Mare Associated with Irregularities of the Oestrous Cycle.

57th Annu. Congr. Nat. Vet. Med. Ass. Gt. Brit. 1939.

Vet. Rec. 1939, **51**, 1113-1126.

The yearly infertility in mares is about 30 to 40 per cent of those bred, but permanent sterility is not very common. The main causes of barrenness are inappropriate time of mating, use of a stallion of low fertility, irregularities of the oestrous cycle, and abnormal conditions of the genital tract. On a well managed breeding stud irregularities of the oestrous cycle are the chief cause of sterility.

Cystic ovaries and irregularities of the oestrous cycle are mainly the results of abnormal pituitary stimulation. This results partly from mares being in poor, unthrifty or even fat condition, and also mating before the normal breeding season.

A description is given of the changes which take place in the ovaries and genital tract in the mare during a normal oestrous cycle, and in mares with irregular cycles.

Operative treatment for puncturing ovarian cysts is described and methods for controlling oestrus and ovulation by injection of gonadotrophic hormones are discussed.

630* EDWARDS, J.

The Effect of Unilateral Castration on Spermatogenesis.

Proc. Roy. Soc., Lond. 'B'. 1940, **128**, 407-421.

The effect of unilateral castration in the sexually mature rabbit on the production of spermatozoa has been studied quantitatively by means of semen exhaustion tests.

The frequency of collection is shown to have kept pace with the rate of production of spermatozoa by the testis.

Contrary to what occurs in the ovary there is no hypertrophy of spermatogenic function or of weight of testis following unilateral castration.

There is a highly significant positive relationship between the weight of the testicular substance and the numbers of spermatozoa which it produces.

The passage of spermatozoa through the epididymis may be accomplished in 4-7 days.

601* HAMMOND, J.

Physiological Aspects of Bovine Sterility.

57th Annu. Congr. Nat. Vet. Med. Ass. Gt. Brit., 1939.

Repr. in *Vet. Med.* 1939, **34**, 638.

A short summary of recent work under the following headings :—the bull ; the preliminaries to fertilization ; ovarian cysts ; the *corpus luteum* ; ovarian inactivity ; and gonadotrophic hormones.

653* MARSHALL, F. H. A.

The Experimental Modification of the Oestrous Cycle in the Ferret by Different Intensities of Light Irradiation and other Methods.

J. Exp. Biol. 1940, **17**, 139–146.

With female ferrets subjected to different degrees of intensity of light irradiation as measured by placing them at different distances from a 1000 W. lamp, the acceleration of the oestrous cycle, generally speaking, was correlated with the degree of intensity. There were, however, individual exceptions. The distances between the ferrets and the lamp varied from 1 to 22 ft.

Female ferrets subjected to ultra-violet irradiation usually remained on heat until much later in the year than those submitted to light irradiation. With male ferrets ultra-violet ray irradiation caused descent of the testes in December and the testes remained descended until the autumn.

Irradiated female ferrets (both with light and ultra-violet rays) went off heat shortly after being put with males and probably as a result of copulation (which, however, was not always observed), but pregnancy did not supervene. This may have been due to the animals not being in a state for ovulation.

Feeding vitamin D to anoestrous ferrets did not result in accelerating the cycle, the ferrets not coming on heat until the normal time. The treatment, however, resulted in their becoming abnormally fat. Vitamin D was given in a commercial preparation which also contained vitamin A.

Sections through the ovaries of irradiated oestrous ferrets showed large ripe follicles and other follicles in varying degrees of development. Some apparently unruptured degenerate follicles were also seen. There were no cystic follicles in any of the ferrets' ovaries observed. Typical interstitial cells were present usually in great abundance.

In a ferret that had been submitted to ultra-violet irradiation the ovaries contained a quantity of old luteal cells, the presence of which suggested that some of the follicles had become lutealized without rupturing.

The uterus in three of the irradiated ferrets was somewhat congested and showed signs of glandular activity, being, generally speaking, similar to that of normal ferrets which have been on heat a long time. The uterus of a female ferret, in which the ovaries contained old luteal cells, presented the appearance of one belonging to an animal that was coming on heat again after pregnancy or pseudo-pregnancy.

627* MARSHALL, F. H. A., VERNEY, E. B. & VOGT, M.

The Occurrence of Ovulation in the Rabbit as a Result of Stimulation of the Central Nervous System by Drugs.

J. Physiol. 1939, **97**, 128–132.

Picrotoxin in a dose of 0·9–1·1 mg./kg. was injected intravenously into rabbits on heat. Follicle growth, development of batches of cystic and of haemorrhagic follicles, or ovulation ensued in a large number of animals so treated. No ovarian responses were obtained to the injection of a series of other substances, most of which were stimulants of the central nervous system.

603* MILLER, W. C. & DAY, F. T.

The Diagnosis of Equine Pregnancy.

J. R. Army Med. Corps. 1939, **10**, 95–105.

Detailed technique for carrying out the blood-serum and urine tests, rectal palpation and the mucin smear test is given. Results of the uses of these tests are discussed, explanations are given for some of the errors encountered, and the best stage of pregnancy for the use of each individual test is mentioned. A series of plates are included showing negative and positive smears for the mucin and urine tests.

652* PARKES, A. S. & HAMMOND, J.

Induction of Fertility by the Injection of Gonadotrophic Preparations.

Proc. Roy. Soc. Med. 1940, **33**, 483–486.

PINCUS, G. & WERTHESSEN, N. T.

The Maintenance of Embryo Life in Ovariectomized Rabbits.

Amer. J. Physiol. 1938, **124**, 484-490.

It is inferred that one need not invoke any special gestational substances other than progesterone for maintaining full gestation in the ovariectomized rabbit, but substances related to progesterone and not themselves progestins, e.g. pregnandiol, oestrone, may effectively enhance the typical progesterone effect by preventing the rapid destruction of progesterone.

ANIMAL PRODUCTION.

EDWARDS, J.

The Effect of Season, Stage of Lactation and Month of Calving on the Fat Concentration of Milk.

C. R. Congr. Int. Zootech. Zürich, 1939, 282.

The effects of these factors are studied after making allowance (correcting) for the variation in fat per cent which is caused by fluctuating milk yield. It is found (1) that "season" affects fat concentration independent of seasonal fluctuations in milk yield (2) that the effect varies at different stages of lactation (3) that the effect on A.M. concentration is greater than that on P.M. concentration (4) the stage of lactation *per se* does not affect fat concentration, and (5) that the effect of month of calving is the resultant of the various "seasonal" effects. It is suggested that under English conditions the most important "seasonal" factors are (a) the condition of the cow when she calves and (b) the type of nutrition existing, e.g. pasture or concentrate ration, when the later stages of lactation are reached.

649* HIRZEL, R.

Factors Affecting Quality in Mutton and Beef with Special Reference to the Proportion of Muscle, Fat and Bone.

Onderstepoort J. Vet. Sci. 1939, **12**, 379-554.

A statistical analysis is made of measurement of mutton and beef carcasses exhibited at the Smithfield Fat Stock Shows from 1921 to 1932 inclusive. Measurements of the winners are taken as the standard for comparison and the breed averages have been compared with these to show up the good and bad points of the breed for carcass quality. A "scale of points" for judging mutton carcasses based particularly on measurements is outlined. There is a close connection between weight, fatness and price of carcass. Most breeds make top prices at their lightest weight, irrespective of finish: at shows, weight classes should be substituted for age classes. With weight increase due to age, fat increases most, muscle next and bone least. Increase in the weight of an animal is a much more potent factor in increasing the proportions of muscle, fat and bone in the carcass than is increase in age independent of weight changes. In cross-breeding the offspring approach the quantitative intermediate. An increase in fatness at any one age has more effect on marbling fat than has an age increase, although marbling is affected by age. Observations are reported on the factors influencing (a) the colour of the flesh (b) the colour of the fat and (c) the firmness of the fat.

580* McMEEKAN, C. P.

The Nature and Variability of the Carcass Characters of Danish and English Bacon Pigs.

J. Agric. Sci. 1939, **29**, 131-141.

The quality status of Danish and English Wiltshire bacon sides representative of the highest grades produced at the present time has been investigated by the use of carcass measurements. The data resulting provide "standards" for practical guidance in stock improvement work on bacon pigs, and for the evaluation of experimental treatments involving bacon quality.

The variability of the respective characters has been compared by means of the coefficient of variation of each. The results indicate that while selection on a basis of "external characters" and of such internal characters, as are readily measurable, leads to marked uniformity in respect of these characters, it does not necessarily involve similar uniformity in respect of important "internal characters" which are not taken into account in either stock selection or commercial grading practices.

External characters thus do not provide a reliable indication of the internal quality status of the bacon pig, and since it is the latter which largely governs the cutting value of the side, concentration upon addition to the former is desirable if still further improvement in the quality of the bacon pig is desired.

Variability appears to be affected also by the rate of development of the character concerned ; late developing characters in general tend to be more variable than early.

The intimate association between nutrition and the rate of development of the various parts and tissues of the pig provides a method of control in addition to that of selection.

McMEEKAN, C. P. & HAMMOND, J.

The Effect of the Shape of the Growth Curve on the Conformation and Composition of the Pig.

C. R. Congr. Int. Zootech. Zürich, 1939. 269.

The object of this investigation was to determine how the changes in the body proportions could be controlled. This was done by regulating the growth curve to predetermined shapes by controlling the plane of nutrition. By making the growth curve rise quickly those parts and tissues, such as the loin and the fat, which develop late in life, are increased to a much greater degree than those, such as the head and bone, which develop early in life. By making the growth rapid early in life and slowing it down later, the early developing parts and tissues are accentuated and the later developing parts and tissues are reduced. The converse is also true.

599* McMEEKAN, C. P. & HAMMOND, J.

Improvement in the Carcass Quality of Pigs.

Agriculture : J. Minist. Agric. 1939, 46, 238-243.

La Res. 1939 (133), 8525.

A popular account of some of the aspects of work done by McMeekan on "growth and the development of carcass qualities in the pig". After describing the normal growth changes in body proportions and composition it is demonstrated that these can be controlled by changing the shape of the growth curve.

638* PÁLSSON, H.

Meat Qualities in the Sheep with Special Reference to Scottish Breeds and Crosses. I.

J. Agric. Sci. 1940, 30, 544-626.

By establishing the relationship between linear carcass measurements and the quantitative composition of the carcass in terms of bone, muscle and fat, a scientific basis has been provided for the use of many measurements hitherto only presumed to provide an index to carcass quality.

External carcass measurements are correlated with weight of the skeleton. The most useful for this purpose are length of tibia + tarsus and length of the fore-cannon.

As indices of muscle, external measures are only of indirect value.

For muscle and fat internal measures permit a more precise estimate to be made.

Still better indices for muscle and fat are provided by suitable combinations of external and internal measurements. For bone, a most efficient single index is shown to be the weight of the fore-cannon bone.

The weight of the skeleton can be estimated with a high degree of accuracy from the weight of the bones in either one leg or loin. Both these joints combined, however, provide a still better estimate.

The muscle in one leg or loin + leg provides an excellent index of the weight of muscle in the whole carcass.

The fat in one leg, loin, or both these joints combined, provides a good index of the weight of the total fat in the carcass. Both joints combined give the most precise measure.

The value of certain measurements which are not necessarily associated with the quantity of the major tissues of the carcass, but which nevertheless have important qualitative significance, is emphasized.

Data on carcass quality measurements and weights of lambs and hoggets of various Scottish breeds and crosses have been analysed statistically. In addition, data on lambs of the Iceland breed and its cross with the Border Leicestershire as well as hoggets of the Suffolk breed have been incorporated in this study.

At constant carcass weight marked breed differences in body conformation exist.

The weight of bone in the carcass varies greatly with breed, as judged by the weight of the left fore-cannon. The small and/or early maturing breeds, have much lighter skeletons than the larger and/or later maturing ones.

None of the breeds is too fat on the loin as lambs, but at light weights some, particularly the large framed types, are too lean.

638* PÄLSSON, H.

**Meat Qualities in the Sheep with Special Reference to Scottish Breeds and Crosses.
II. Part 3. Comparative Development of Selected Individuals of Different Breeds
and Crosses as Lambs and Hoggets.**

J. Agric. Sci. 1940, **30**, 1-82.

Complete anatomical dissection of eleven wether lambs at approximately 4·5 months old and 40 lb. carcass weight and five wether hoggets at approximately 13 months and 60 lb. carcass weight provided material for a comparative study of the anatomical composition and characters of different breeds and crosses of which the individuals concerned were selected as representative.

From the differential development of the different parts and tissues of the body in the various breeds and crosses, the concept of early and late development as a fundamental factor in meat production is demonstrated.

The proportional development of the various parts of the body and its major tissues in lambs and hoggets is compared. In the total carcass, bone has increased least, muscle only slightly more and fat most, with an increase in age from 4·5 to 13 months and body weight from 40 to 60 lb. This is in line with the order of the development of the tissues.

The differential effect upon differentially developing tissues of the plane of nutrition is advanced as a major factor influencing the relative differences between lambs and hoggets.

Variations, affecting the value of the animal for meat production, in the number of vertebrae in the different anatomical regions have been described.

The bearing of the many factors discussed and principles elucidated upon practical problems of lamb and mutton production has been considered.

655* SHORROCK, R. W.

Co-ordinated Experiments in Pig Husbandry.

Emp. J. Exp. Agric. 1940, **8**, 159-167.

The organization, by the Pig Experiments Co-ordinating Committee, of co-operative investigation of pig husbandry problems at various centres in Great Britain is described. The method of analysis adopted in dealing with pre-slaughter data and carcass records, and with the combined data from numerous centres, is briefly discussed and illustrated with examples.

THOMASSET, L. F.

A Very Simple Apparatus for Measuring Wool.

C. R. Congr. Int. Zootech. Zürich, 1939. 297.

A simple apparatus is described to enable the farmer to accustom himself to estimate wool fineness in terms of commercial qualities.

OTHERS PAPERS.

GARNER, F. H.

Fewer Losses in Winter Litters.

Fmr's Wkly. 1940, **12** (6), 39.

GARNER, F. H.

Milk Recording in Wartime.

Fmr's Wkly. 1939, **11** (24), 23-24.

GARNER, F. H.

Too Many Dairy Stores.

Fmr & Stk-Breed. 1938, **52**, 3039.

586* HAMMOND, J.

The Dairy Industry in New Zealand and Australia.

Lancs Milk Rec. Soc. Yearb. 1939.

Rep. Cent. Coun. Milk Rec. Soc. 1938, 57-63.

HAMMOND, J.
Milk Production in Wartime.
Shorthorn J. 1940, **9**, 150–152.

HAMMOND, J.
Pigs and Lambs for Export.
Chron. Stud Stk Suppl. Adelaide. 31 August, 1939.

HAMMOND, J.
Sheep Industry in Australia.
Camb. Univ. Agric. Soc. Mag. 1939, **6** (1), 10–13.

656* HAMMOND, J.
Some Factors Affecting the Quality and Composition of Meat.
Chem. & Ind. 1940, **59**, 521–525.

HAMMOND, J.
Die Tierproduktion in England.
Disch. Landw. Tierz. 1939, **43**, 588.

MANSFIELD, W. S.
Beef Production in War Time.
Agriculture : J. Minist. Agric. 1940, **46**, 639–643.

POMEROY, R. W.
Review of N.P.B.A. Bacon Carcass Competition, 1932–37.
Pig Breed. Annu. 1939/40, **19**, 23–29.

POMEROY, R. W.
Review of Pig Experimental Work at Cambridge, 1938–39.
Pig Breed. Annu. 1939/40, **19**, 123–126.

FORESTRY.

562* THOMPSON, C. H.
The Present Position of Forestry at Cambridge University.
Quart. J. For. 1938, **32**, 251–256.

THOMPSON, C. H.
The Private Woodland Owner's Approach to a National Land Policy.
Quart. J. For. 1940, **34**, 98–107.

PLANT BREEDING AND GENETICS.

BELL, G. H. D.
Crops and Plant Breeding.
Fmr's Guide Agric. Res. 1937. *J. R. Agric. Soc.* 1938, **99**, 115–163.
The grassland section of this account of recent research deals with management, breeding and seed production, and growth habit and rhythm. Potato breeding is discussed largely in relation to disease resistance, while short sections on wheat, barley and oats are also concerned with diseases, although other questions such as yield and protein content and varietal distribution are also considered. The recent work on the excretion of nitrogenous compounds by leguminous plants, and the theoretical and practical considerations in relation to hybrid vigour are also described. The article concludes with one section on general pathology, and another on the control of development and flowering in plants.

BELL, G. H. D.

Crops and Plant Breeding.

J. R. Agric. Soc. 1939, **100** (1), 5-36.

This review discusses grassland management and improvement and includes a brief reference to herbage plant breeding, seed production and grassland ecology. Wheat, barley, potatoes, sugar beet, hops, lucerne, lupins and fodder mallow are discussed with reference to breeding, inheritance, diseases and new varieties. The final section on physiology deals with yield, the effect of temperature and light, soil sickness and hormones.

BELL, G. H. D.

Crops and Plant Breeding.

J. R. Agric. Soc. 1940, **101** (1), 1-33.

The grassland section is devoted primarily to reclamation and improvement. Recent research of economic importance on wheat, barley, oats, potatoes, sugar beet, leguminous and *Brassica* crops is described. Special accounts are given of the most recent variety trials in the cereals, potatoes and sugar beet, and there are short sections on seed disinfection and physiological research.

593* BELL, G. D. H.

A Study on the Date of Ear Emergence in Barley.

J. Agric. Sci. 1939, **29**, 175-228.

The date of ear emergence in barley is taken as an example of a physiological character which it is necessary to analyse and study physiologically, particularly in relation to the effect of environmental conditions, before genetic interpretation of the behaviour of hybrid progenies is possible. Several crosses between parents differing in their dates of ear emergence are studied from this point of view, and attempts are made to correlate the various genetic results with the physiological peculiarities of the parents. Attention is drawn to the discrepancy between F_2 and F_3 behaviour in certain of the crosses, and the inadequacy of simple genetic interpretations suggested by a study of F_2 populations.

611* ELLERTON, S.

The Origin and Geographical Distribution of *Triticum sphaerococcum* Persc. and its Cytogenetical Behaviour in Crosses with *T. vulgare* Vill.

J. Genet. 1939, **38**, 307-324.

T. sphaerococcum differs from *T. vulgare* by a single gene, *S*, and is recessive to that species. It is confined to a limited region of India centred in the Punjab. The types studied showed a high frequency of speltoid mutations in the F_2 of crosses with *T. vulgare*, which was correlated with the presence of a reciprocal interchange between chromosomes.

FYFE, J. L.

The Action and Use of Colchicine in the Production of Polyploid Plants. Pp. 10.

Imp. Bur. Pl. Breed. & Genet., Cambridge. 1939. Price 1s.

A review of the literature up to the end of January, 1939.

629* HOWARD, H. W.

The Cytology of Autotetraploid Kale, *Brassica oleracea*.

Cytologia. 1939, **10**, 77-87.

A variable number of quadrivalents and numerically irregular disjunctions were observed at meiosis in autotetraploid kale. Secondary associations were also studied.

608* HOWARD, H. W.

The Size of Seeds in Diploid and Autotetraploid *Brassica oleracea* L.

J. Genet. 1939, **38**, 325-340.

The mean weights of single *Brassica oleracea* (thousand-head kale) seeds were diploid 0.00408 g., tetraploid 0.00534 g., triploids from tetraploid female \times diploid male 0.00120 g. and "seeds" containing no embryos from diploid female \times tetraploid male 0.00046 g. The peculiar seed development in the crosses is explained as being due to abnormal embryo-endosperm relationships. Two types of exceptional seeds produced further evidence for this explanation. Fifty-four double seeds of marrow-stem kale were obtained and one of 106 embryos was found to be tetraploid. The rest were diploids.

660* HOWARD, H. W. & MANTON, I.

Allopolyploid Nature of the Wild Tetraploid Watercress.

Nature. 1940, **146**, 303–304.

An artificial autotetraploid watercress was made by colchicine treatment of diploid seedlings. Studies of meiosis in this artificial autotetraploid, in the wild tetraploid, in the hybrid between the two tetraploids and in the hybrid wild tetraploid × diploid show that the wild tetraploid is an allotetraploid and not an autotetraploid.

HUNTER, H.

Developments in Plant Breeding.

Contribution to *Agriculture in the Twentieth Century*. Pp. 223–260. Camb. Univ. Press, 1939. Price 15s.

594* HUNTER, H.

Various Aspects of Malting Barley Breeding.

J. Inst. Brew. 1939, **45**, 286–298.

J. Incorp. Brew. Guild. 1939, **25**, 177–192.

PUNNETT, R. C.

Forty Years of Evolution Theory.

Contribution to *Background to Modern Science*. Pp. 191–222. Ed. by J Needham. Camb. Univ. Press, 1938. Price 7s. 6d.

PUNNETT, R. C.

Notes on the D-Chromosome of the Sweet Pea.

J. Genet. 1940, **39**, 301–308.

SALAMAN, R. N.

Potatoes—a Retrospect 1918–1938.

J. Nat. Inst. Agric. Bot. 1939, **4**, 422–432.

A review of the development in respect to the production of new varieties, health of seed, abolition of synonyms, testing of cropping capacities and maturity of varieties and the like which have been brought about directly or indirectly by the activities of the National Institute of Agricultural Botany during the last twenty years.

STEBBINS, G. L. & ELLERTON, S.

Structural Hybridity in *Paeonia californica* and *P. Brownii*.

J. Genet. 1939, **38**, 1–36.

The plants studied in both species were complex interchange heterozygotes with rings of six, eight or ten chromosomes. The configurations were studied from the point of view of the chromosome mechanics of ring formation and also with regard to the evolution of the subgenus *Onaepia* of the genus *Paeonia*.

631* WATKINS, A. E.

The Inheritance of Glume Shape in *Triticum*.

J. Genet. 1940, **39**, 249–264.

It is shown that the characters of the empty glume and the brittleness or toughness of the rachis, generally used in the genus *Triticum* for diagnosing species, depend on series of linked genes occurring four times in the tetraploid wheats and six times in the hexaploids.

650* WATKINS, A. E. & ELLERTON, S.

Variations and Genetics of the Awn in *Triticum*.

J. Genet. 1940, **40**, 243–270.

The awn types found in tetraploid and hexaploid wheats are described and classified. The genes responsible for the differences concerned were worked out from a series of crosses, and a number of standard lines of known genetical composition established.

OTHER PAPERS.

ENGLEDOW, F. L.

Biggest Wheat Ear and Wheat Plants.
Fmr & Stk-Breed. 1939, **53**, 2913.

SALAMAN, R. N.

Potato Seed: an Urgent Problem.
Gdnrs' Chron. 4 May, 1940.

SALAMAN, R. N.

Report of the Potato Synonym Committee, 1938.
J. Nat. Inst. Agric. Bot. 1939, **4**, 403-407.

PLANT NUTRITION.

628* WOODMAN, R. M.

The Effects of a Deficiency of Certain Essential Elements on the Development and Yield of Carrots, Onions and Radishes Grown in Sand Cultures under Glass.
J. Pomol. 1940, **17**, 297-307.

Observations on the behaviour of the root crops, carrot, onion and radish, grown in sand culture, are recorded. Deficiency symptoms are described, and quantitative data as to the yields and ratios of the different parts of the plants are tabulated and statistically examined.

Lack of potassium produced in general a tendency to scorch and wilt of portions of the tops of the plants. Deficiency of nitrogen resulted in onion tops of a very pale green colour, and in a very characteristic outlining in red of the cotyledons of the radish plant. With the solutions used and under the conditions described, the deficiencies of nitrogen and phosphorus resulted in greatly diminished yields. The reductions in yields with the solutions containing small amounts only of the elements potassium, calcium, and magnesium, however, were much smaller.

598* WOODMAN, R. M.

Effects of Variation in the Supply of Potash to Lettuces Grown under Glass.
J. Pomol. 1939, **17**, 167-180.

Deficiency symptoms of May King lettuces receiving insufficient supplies of potash are noted. The yield data at maturity and at four seedling stages are statistically examined.

639* WOODMAN, R. M.

The Nutrition of Lettuces Grown as Sand Cultures under Glass.
Ann. Appl. Biol. 1940, **27**, 5-16.

May King lettuce has been shown to respond well to nitrogen and phosphorus both as regards yield and earliness of maturity, but to make practically no response to potassium over a wide range of concentrations. Cheshunt Early Giant lettuce behaved similarly, but no development of purple flushes or tints took place with this non-tinted lettuce when there was a deficiency of phosphorus or nitrogen; a deficiency of nitrogen, however, resulted in a light green lettuce of a characteristic and abnormally regular and smooth appearance.

Lack of calcium with May King did not cause deficiency symptoms other than that of decreased yield. A deficiency symptom noted with magnesium was a tendency to an etiolated plant and to a bleached whitish pink appearance of the older leaves.

Yields and other data have been examined statistically.

613* WOODMAN, R. M.

Studies in the Nutrition of Vegetables. The Effects of Variation in the Nitrogen Supply on Lettuce (var. May King) in Sand Culture.
Ann. Bot. 1939, **3** (N.S.), 649-656.

A progressive reduction in the amount of nitrogen applied as sodium nitrate to sand cultures of May King lettuce resulted in a progressive reduction in size and weight, a progressive development of anthocyan pigment, and finally a tendency to etiolation of the remaining green portions of the leaves with sometimes formation of a golden-yellow colour in the oldest leaves.

An adequate supply of nitrogen tended to earlier hearting, and favoured the growth of tops rather than of roots.

607* WOODMAN, R. M.

Studies in the Nutrition of Vegetables. The Effects of Varying the Potash Supply on Sand Cultures of Lettuce.

Soil Sci. 1939, **48**, 101-108.

May King lettuce grown in sand showed very little response to potassium over a wide range of concentration. Small amounts gave moderately good growth, although a complete absence of potash resulted in a small plant. The ready availability of the potassium supplied in culture experiments is possibly responsible for the small amount required as compared with the comparatively large amounts recommended for growth of the plants in soil.

Lack of potash first gave a slightly darker leaf than normal, but later tended to cause chlorosis. Scorch appeared with small amounts of potash, even when these were not small enough to cause an appreciable reduction in size. Absence of potash resulted in such rapid, severe scorch and withering away of the older leaves that ultimately a characteristically small, narrow, relatively tall and erect plant resulted; the portions of the leaves between the abnormally wide veins were convex on the upper surface and gave the leaves a characteristic wavy appearance; these areas were at first darker green than normal, but later became chlorotic.

Large applications of potash did not induce earlier hearting.

592* WOODMAN, R. M.

Studies in the Nutrition of Vegetables. Phosphate Deficiency and Yield Tests on Sand Cultures of May King Lettuce.

J. Agric. Sci. 1939, **29**, 229-248.

Deficiency symptoms are noted, and the yield data at maturity and at four seedling stages are statistically examined.

PLANT PATHOLOGY.

585* DENNIS, R. W. G.

Notes on the Photoperiodic Reactions and Virus Contents of some Peruvian Potatoes.

Ann. Appl. Biol. 1939, **26**, 87-101.

Exposure of the Peruvian potato varieties to full summer-day conditions at Cambridge resulted in a more uniform growing period, and increased the tendency to bloom. The effect on tuber production varied according to the variety. In most types the weight and number of tubers were not adversely influenced, but there was a tendency to elimination of the dormancy period and to conversion of the stolons into aerial shoots. In a few varieties there was no adverse influence, and in the members of one small group plants exposed to full-day conditions formed no tubers.

Investigation of virus content showed that of fifty-nine varieties only eleven were healthy. In the remaining forty-eight varieties there were found viruses apparently identical with those known in this country as *X*, *B*, *C*, *F*, *G*, and perhaps leaf roll.¹ There was also evidence of the presence of other viruses, suggesting the existence in South America of a virus complex, only isolated members of which have hitherto been known in Europe. It follows that great caution should be exercised in introducing South American varieties into potato-growing districts.

584* DENNIS, R. W. G.

Studies on Solanum Virus 4.

Phytopathology. 1939, **29**, 168-177.

Solanum virus 4 (B) was freed from contamination with Solanum virus 1 (X) by passage through the potato variety U.S.D.A. 41956. Its reactions, other than on the potato, have been studied on 18 hosts, of which *Datura stramonium* and *Lycopersicum esculentum* are found to be of the greatest value for diagnostic purposes. On the former the virus induces a bright systemic mottle with slight necrosis and deformity; on the latter a characteristic yellow interveinal mottle develops.

¹ Equivalent respectively to the *Solanum* viruses 1, 4, 5, 8, 9 and 14 of Dr. K. M. Smith's classification. *Solanum* virus 6 of the same classification is the foliar necrosis strain of *X*.

It has been found possible to infect King Edward and Arran Crest potatoes with Solanum virus 4 by sap inoculation, and the virus has been recovered unchanged from the former variety following such infection. In other potato varieties sap inoculation results in local lesion formation only.

Solanum virus 4 was inactivated at 70° C., but not at 65° C., it endured dilution in tobacco sap to 1 : 100,000 and survived in expressed sap for 6 weeks.

Mixed infections of this virus with Nicotiana virus 1 and Solanum virus 2, respectively, confirm its affinity with Solanum virus 1.

Reinoculation experiments on tobacco, *Datura*, or potato show that previous infection of a host with either Solanum virus 1 or Solanum virus 4 does not prevent subsequent infection with the other virus.

It is concluded that the strain of Solanum virus 4 studied, was free from contamination with other viruses, and that the reactions described are, therefore, caused by it alone.

581* PIRIE, N. W., SMITH, K. M., SPOONER, E. T. C. & MACCLELLANT, W. D.
Purified Preparations of Tobacco Necrosis Virus (*Nicotiana Virus 11*).
Parasitology. 1938, **30**, 543–551.

Two nucleoproteins with similar chemical composition have been isolated from the leaves of tobacco plants infected with tobacco necrosis virus. One of these is crystalline and has a sedimentation constant of 130×10^{-12} ; the other is amorphous and its principal component has a sedimentation constant of 58×10^{-12} .

Each preparation will infect plants at a dilution of 1 in 10^8 and will precipitate specifically with antiserum at a dilution of 1 in 3.2×10^5 .

The nature of the difference between preparations in the two states is obscure and it has not proved possible to convert the one into the other.

SALAMAN, R. N.

Outlines of the History of Plant Virus Research.

Contribution to *Agriculture in the Twentieth Century*. Pp. 261–289. Camb Univ. Press, 1939.
Price 15s.

661* SALAMAN, R. N. & WORTLEY, W. R. S.
Potential Hosts of Potato Viruses in Garden and Field.
Nature. 1939, **144**, 1049.

610* SMITH, K. M.

Plant Viruses. II.

Tabul. Biol. 1939, **17**, 24–71.

The main facts about plant viruses are here collected together and presented in tabular form. All known plant viruses are included and the following data are given:— methods of transmission, insect vectors, differential hosts, chief symptoms, main host plants, distribution, control and references.

583* SMITH, K. M.

The Study of Plant Viruses, with Special Reference to their Insect-relationships and Some Comparisons with the Animal Viruses.

Trans. R. Soc. Trop. Med. Hyg. 1939, **32**, 557–566.

The relationships of plant viruses with insect vectors are discussed in some detail and comparisons are made with the relationships of animal viruses and insect vectors. It is shown that while some animal viruses undoubtedly multiply inside their insect vectors, similar multiplication of plant viruses has not yet been demonstrated.

SMITH, K. M.

The Virus : Life's Enemy.

Cambridge Library of Modern Science. Camb. Univ. Press, 1940. Pp. viii + 176. Price 7s. 6d.

632* SMITH, K. M. & DENNIS, R. W. G.

Some Notes on a Suspected Variant of *Solanum Virus 2* (Potato Virus Y).

Ann. Appl. Biol. 1940, **27**, 65-70.

An account is given of an apparent variant of *Solanum Virus 2* (potato virus Y) which differs slightly from the type virus in its symptoms and sharply in its longevity *in vitro*. It is accompanied in the tobacco plant by a necrotic symptom which is suspected to be due to a separate virus of very unstable character.

SMITH, K. M. & MACCLEMENT, W. D.

Aggregation of Purified Tobacco Mosaic Virus.

Nature. 1938, **142**, 843.

This letter discusses the aggregation of tobacco mosaic virus particles and the filtration end-point of the virus after various methods of purification.

663* SMITH, K. M. & MACCLEMENT, W. D.

Filtration Studies on *Nicotiana Virus II*.

Parasitology. 1940, **32**, 320-332.

An account is given of ultrafiltration studies with *Nicotiana Virus II* (tobacco necrosis virus). It is shown that although the filtration end-point is about $40m\mu$, there is invariably a sharp drop in the local lesion counts between the membrane pore sizes 250 and $125m\mu$. This phenomenon shows itself as a bench or shelf with an upward trend in the filtration curve. A number of possible explanations are given.

From the filtration end-point the particle size of the virus is computed to be between 13 and $20m\mu$.

WESTON, W. A. R. DILLON.

Methods of Seed Disinfection.

Agriculture : J. Minist. Agric. 1939, **46**, 593-601.

An account of various materials which have been used for the disinfection of seed grain. The older wet treatments are discussed and also the modern organo-mercury seed disinfectants and protectives.

619* WESTON, W. A. R. DILLON.

Modern Methods of Seed Disinfection.

Ann. Appl. Biol. 1939, **26**, 636-640.

An account of modern seed disinfectants and protectives of the organo-mercury type.

662* WESTON, W. A. R. DILLON & BRETT, C. C.

Seed Disinfection.

Nature. 1940, **145**, 824.

Is there any risk of organo-mercury seed disinfectants injuring the vitality of grain? Occasionally under certain abnormal conditions cases of injury have been noted. In some the seed has been killed and in others it has commenced to germinate and the shoot to appear, but further development has been abnormal and characterized by thickening of the tissues of the shoot and stunting of the roots. Typically abnormal seedlings seldom develop further, and neither they nor the killed seeds decay rapidly in the soil. Such cases, however, are relatively rare and are due to incorrect treatment. We find that provided the grain shows relatively high initial germination, is of sound physical condition and is superficially dry when dusted with these materials, then no immediate injury to the grain is likely to result. If such seed has to be stored, then provided it is kept under dry, cool conditions, with adequate ventilation, it is unlikely that any significant loss of germination capacity will ensue during several months. With such well-conditioned seed it is not possible to give any markedly excessive doses, as the dust cannot be retained by superficially dry seed beyond a certain limit.

A factor of some importance appears to be the relative superficial moisture of the seed. If such seed, i.e. damp seed, is dusted, even at the recommended rate, that part of the bulk of seed upon which the dressing falls will retain excessive quantities. The subsequent mixing will result in a distribution throughout the bulk of a proportion of heavily over-dusted seeds. These

may be killed or may produce abnormal seedlings, thus resulting in an uneven stand. Intentional or accidental application of dust to damp seed, at rates higher than those recommended, will tend to produce more markedly adverse results.

Injury may also result if dry and well-conditioned grain is treated at normal rates but is afterwards stored under damp conditions with poor ventilation.

612* WORTLEY, W. R. S.

The Effect of Lithium on Mildew and Wheat. A Summary.

Trans. Brit. Mycol. Soc. 1939, **23**, 122.

OTHER PAPERS.

569* SALAMAN, R. N.

The Fight against Potato Disease.

J. Minist. Agric. 1938, **45**, 881-889.

609* SMITH, K. M.

Choroby Zakazne u Roslin.

Przyroda i Tech. 1939, **3**, 133-136.

SMITH, K. M.

The Tomato and The Cigarette.

J. R. Hort. Soc. 1940, **65**, 243-244.

WESTON, W. A. R. DILLON.

Methods of Seed Disinfection.

Agriculture : J. Minist. Agric. 1939, **46**, 593-601.

WESTON, W. A. R. DILLON.

Seed Treatment.

Agriculture : J. Minist. Agric. 1940, **47**, 103-106.

PLANT PHYSIOLOGY.

570* HOWARD, H. W.

Possible Action of Photohormones as Root-Determiners.

Ann. Bot. 1938, **2** (N.S.), 933-942.

Decapitated kale (*Brassica oleracea*) seedlings were smeared on the sides of their stems with indole-3-acetic acid paste. Adventitious roots and shoots were produced. It is suggested that indole-3-acetic acid has two functions, first the initiation of adventitious meristems and secondly a root-determining action on these meristems.

659* KENT, N. L.

Quantitative Analysis of Plant Tissues for Lithium by the Ramage Flame Spectrographic Method.

J. Soc. Chem. Ind. 1940, **59**, 148-153.

An adaptation of the Ramage flame spectrographic method for determining the concentration of lithium in plant tissues is described, and has been applied to the determination of the concentration of lithium in various parts of healthy wheat and celery plants—both normal and lithium treated—and also that in tomato crown galls and dead leaves. For each species of plant examined there was a high correlation between the concentration of lithium in the soil and the concentration in the plant; the greatest accumulation of lithium in wheat occurred in the oldest leaves, and in celery, in the margin of the largest leaves. The tolerance of the three species for lithium was in the decreasing order, wheat, celery, tomato. It is deduced from the results of experiments that the plants used have little power of preventing the absorption of lithium; it is suggested that accumulation of lithium in the leaves depends more on their growth rate than upon transpiration.

SOILS AND MANURES.

642* CHILDS, E. C.

A Recording Water-flow Meter.

J. Sci. Instrum. 1940, **17**, 93-94.

A description is given of a recording meter of simple design, particularly suited for recording the instantaneous rate of flow of water from the outfall pipes of agricultural drainage systems. Two ranges have so far been constructed, with reasonable linearity of scale, dealing with rates of flow up to about forty litres per minute. A record of the water flow from a mole drain in heavy land is shown, illustrating the need for such a recorder in many drainage experiments.

563* HANLEY, F.

A Comparison of Soot and Sulphate of Ammonia as Sources of Nitrogen for the Brussels Sprouts Crop.

J. Minist. Agric. 1938, **45**, 671-681.

Soot and sulphate of ammonia proved equally effective as sources of nitrogen under the conditions of these experiments. No evidence was obtained to suggest that, from the standpoint of its direct effect on the brussels sprouts crop, soot should be valued on any other basis than its content of nitrogen. It is pointed out, however, that no attempt was made to compare cumulative effects on soil tilth or pests in the soil.

573* HANLEY, F. & DAVIES, W. M.

Soil Types and Crop Performance.

J. Minist. Agric. 1939, **45**, 1015-1031.

Crop performance on an area of land about one square mile is compared with data obtained in an earlier field to field survey of the soils of the area. The soil survey provided a satisfactory explanation of some very striking differences in crop growth, variations in crop performance showing a close relationship to the variation in soil type distinguished in the soil survey.

OTHER PAPERS.

GARNER, F. H.

Heaviest Clay and Lightest Sand.

Fmrs' Whly. 1939, **11** (21), 22-23.

GARNER, F. H. & SANDERS, H. G.

Beet Manuring : When to Stop.

Fmr & Stk-Breed. 1940, **54**, 862.

HANLEY, F.

Dung and the Rotation.

J. Minist. Agric. 1938, **45**, 782-787.

HANLEY, F.

Fertilizer Efficiency—Phosphates.

Agriculture : J. Minist. Agric. 1939, **46**, 122-128.

HANLEY, F.

Manuring and Crop Diseases.

J. Minist. Agric. 1938, **45**, 907-912.

HANLEY, F.

Manuring.

J. Minist. Agric. 1938, **45**, 700-704.

HANLEY, F.

Manuring for Potatoes.

J. Minist. Agric. 1939, **45**, 1101-1106.

HANLEY, F.

Manuring for Sugar Beet.

J. Minist. Agric. 1939, **45**, 1202-1207.

HANLEY, F.
Manuring of Grass Land.
J. Minist. Agric. 1939, **45**, 992-997.

HANLEY, F.
Nitrogen in Spring Manuring.
Agriculture : J. Minist. Agric. 1939, **46**, 33-38.

HANLEY, F.
A Survey of the Lime and Phosphate Status of 14,000 Acres in Central Norfolk Husbandry.
1939, **9**, 86-90.

HANLEY, F.
The Use of Soil Analysis.
Husbandry. 1938, **8**, 128-130.
Horticulture. 1939, **2**, 5-8.

NICHOLSON, H. H.
Drainage : the First Step Towards Real Fertility.
Fmrs' Wkly. 1939, **11** (13), 21.

NICHOLSON, H. H.
The Importance of Mole-draining in Present Circumstances.
Agriculture : J. Minist. Agric. 1940, **46**, 671-676.

NICHOLSON, H. H.
Keeping Down Mole-drainage Costs.
Fmr & Stk-Breed. 1940, **54**, 299.

NICHOLSON, H. H.
Mole Draining.
Cambs C. C. Fmrs' Booklet. **13**, 1939.

STATISTICS.

574* HUDSON, H. G.
Population Studies with Wheat. I. Sampling.
J. Agric. Sci. 1939, **29**, 76-110.

The first part of the paper gives an account of the experimental details of two uniformity trials with wheat conducted under farm conditions, and describes the technique used. In each of these experiments 7200 six inch lengths of wheat were observed, and the plant number, stem number, ear number, grain weight and straw weight recorded individually.

From this data a study of the optimum size and shape of sampling units and of the optimum sampling percentage was made. It was found that the optimum size of sampling unit was 6-8 feet of drill row. The shape was of secondary importance provided extremes of length and breadth were avoided—actually 3 ft. of two adjacent drill rows was found to be optimum.

The optimum sampling percentage was shown to be affected by the size of plot and degree of subdivision. The smaller the plot the greater the percentage which must be taken, until, with plots over 1/600th acre, so much has to be taken that sampling is scarcely worth while. Similarly, the greater the degree of subdivision for sampling, the lower the sampling requirements. The author shows that for 1/20th acre plots from 3 to 4½ per cent (according to degree of subdivision) will give an adequate sample ; for 1/100th acre plots 11½ to 15½ per cent is necessary, and for 1/600th acre, 43 per cent is necessary.

The paper also includes a review of the method of assessing grain weight by sampling the grain/total produce ratio, and weighing the total produce, and it is considered that this method is worthy of wider application.

WISHART, J.

Field Trials : their Lay-out and Statistical Analysis.

Imp. Bur. Plant Breed. & Genet., Cambridge. 1940. Pp. 36. Price 2s. 6d.

This bulletin, though designed primarily for the use of plant breeders, will be equally invaluable to experimenters in all branches of agricultural science. It is throughout couched in as nearly as possible non-technical language and all technical terms used are defined. It begins with a clear exposition of the nature of the problems confronting the field experimenter ; there follow sections devoted to the methods of randomized blocks and the Latin Square, multiple factor experiments, confounding and experiments with large numbers of varieties. All the methods are illustrated by examples.

626* WISHART, J.

Some Aspects of the Teaching of Statistics.

J. R. Statist. Soc. 1939, **102**, 532-564.

596* WISHART, J.

Statistical Treatment of Animal Experiments.

J. R. Statist. Soc. Suppl. 1939, **6**, 1-12.

Progress in the direction of laying out animal experiments which permit of adequate statistical examination of the results has been satisfactory of late years. The Cambridge nutrition experiment on pigs is cited as an example, and the advantage of the individual feeding method is stressed. This experiment is made the occasion for examining the growth curves of individual animals. Each sex and ration has its effect measured by a small number of constants derived by fitting curves to both the ordinary and logarithmic data of growth. Analysis of variance of the growth constants, singly or in combination, serves to show up the significance of differences between sexes and between rations.

A series of co-ordinated experiments in pig husbandry is briefly described.

MISCELLANEOUS.

ELLERTON, S.

The Determination of Exposures in Enlarging.

Brit. J. Photogr. 1939, **86**, 391-392.

SHORROCK, R. W.

Sports Turf.

Camb. Univ. Agric. Soc. Mag. 1939, **6** (1), 43-45.

AUTHOR INDEX.

- Bell, G. D. H., 30, 31
Biffen, R. H., 7
Brett, C. C., 36
Callow, E. H., 22
Carslaw, R. McG., 9
Childs, E. C., 38
Cruickshank, E. M., 18, 19
Culpin, C., 7, 11, 23
Davies, W. M., 38
Day, F. T., 14, 24, 25, 26
Deighton, T., 19
Dennis, R. W. G., 34, 36
Ede, R., 7
Edwards, J., 14, 17, 23, 25, 27
Ellerton, S., 31, 32, 40
Engledow, F. L., 33
Evans, R. E., 21, 22, 23
Farm Economics Branch, 9
Fyfe, J. L., 31
Garner, F. H., 6, 7, 8, 9, 17, 0, 23, 24, 29, 38
Graves, P. E., 9, 10
Halnan, E. T., 20, 23
Hammond, J., 15, 17, 25, 26, 28, 29, 30
Hanley, F., 38, 39
Hey, G. B., 7
Hirzel, R., 27
Houston, J., 19
Howard, H. W., 15, 31, 32, 37
Hudson, H. G., 39
Hunter, H., 8, 32
Hutchinson, J. C. D., 19
Jones, D. P., 12
Jones, F. G. W., 12
Kemsley, W. F. F., 7
Kent, N. L., 37
MacClement, W. D., 35, 36
McMeekan, C. P., 15, 27, 28
Mansfield, W. S., 8, 17, 30
Manton, I., 32
Marshall, F. H. A., 26
Menzies-Kitchin, A. W., 10
Miller, W. C., 26
Moore, T., 19
Nicholson, H. H., 39
Oosthuizen, P. M., 22
Pálsson, H., 28, 29
Parkes, A. S., 26
Pease, M. S., 17, 18
Petherbridge, F. R., 11, 12, 13
Petit, G. H. N., 10
Pincus, G., 15, 27
Pirie, N. W., 35
Pomeroy, R. W., 30
Punnett, R. C., 16, 18, 32
Salaman, R. N., 32, 33, 35, 37
Sanders, H. G., 6, 7, 8, 9, 11, 20, 38
Shorrock, R. W., 29, 40
Smith, K. M., 35, 36, 37
Spooner, E. T. C., 35
Stebbins, G. L., 32
Thomasset, L. F., 16, 29
Thompson, C. H., 30
Venn, J. A., 11
Vergés, J. B., 20
Verney, E. B., 26
Vogt, M., 26
Walton, A., 14, 16, 17
Warburton, C., 13
Watkins, A. E., 32
Werthessen, N. T., 27
Weston, W. A. R. Dillon, 36, 37
Wishart, J., 40
Woodman, H. E., 21, 22, 23, 24
Woodman, R. M., 33, 34
Wortley, W. R. S., 35, 37
Wright, D. W., 12, 13, 14

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